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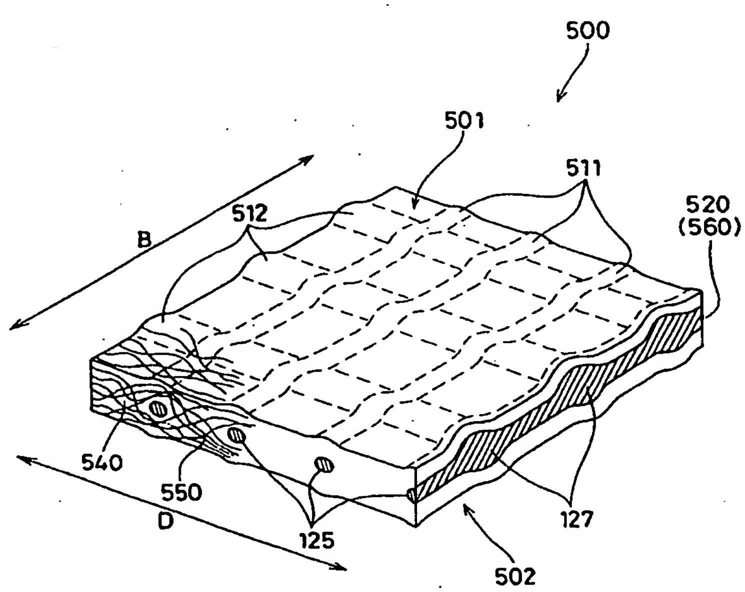

(57) Abstract

The present invention is directed to an elastic composite member which is elastically extensible in at least one direction. The elastic composite member comprises a plane elastomeric material having a plurality of apertures formed therein; and a fibrous material including entanglement fibers. The entanglement fibers are hydroentangled with the plane elastomeric material through the apertures. The fibrous material has a Strain Resistance (SRE) of less than about 100% at 100% elongation in the extensible direction. The present invention is also directed to a disposable article including the elastic composite member.

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ELASTIC COMPOSITE MEMBER AND DISPOSABLE GARMENT USING THE SAME

FIELD

The present invention relates to elastic composite members. More specifically, the present invention relates to elastic composite members which include entanglement fibers hydroentangled with an elastomeric material. The present invention also relates to disposable articles using such elastic composite members. Examples of such disposable articles include sweat bands, bandages, body wraps, disposable underwears, disposable garments including pull-on diapers and training pants, and disposable panties for menstrual use.

BACKGROUND

Elastic members such as elastic laminates and elastic composite members have previously been used in a variety of disposable articles, including sweat bands, bandages, body wraps, and disposable garments including disposable diapers and incontinence devices. Such elastic members typically include at least one elastomeric material and a fibrous material joined to or combined with the elastomeric material. It is generally expected that these products provide good fit to the body and/or skin of the user by using suitable elastic members during the entire use period of products.

Those elastic laminates typically include, at least, an elastomeric material and a fibrous material (e.g., a nonwoven fabric) joined to the elastomeric material. In such elastic laminates these materials are joined together typically through an adhesive (or glue) bond or a heat/pressure bond formed therebetween.

Adhesives are often used for forming elastic laminates. However, the use of such adhesives tends to cause several problems in its manufacturing process and its usage by

consumers. For example, a manufacturing process which includes an adhesive application tends to become more complicated than that which does not need it (e.g., a heat/pressure bond process). In addition, the adhesive application tends to cause a contamination problem in manufacturing equipments or production lines. Further, an elastic laminate which uses an adhesive tends to cause an odor problem to consumers of disposable products, since some adhesive materials tend to have an uncomfortable smell.

A heat/pressure bond is also used for forming elastic laminates. For example, Japanese Laid-Open (Kokai) Patent Publication No. H10-165437 published on June 23, 1998 discloses a disposable diaper which includes a three-layered structure of nonwoven/elastomer film/nonwoven which are bonded together through a number of discontinuous bonding points. However, this structure tends not to provide an enough bonding strength in the layered structure against a stress which is generated in the use of disposable articles (or which may be applied in the manufacturing process thereof), thereby causing a separation of the layered materials. It is believed that this problem is caused because the layered structure does not have an enough bonding strength required by the disposable articles.

Elastic composite members which include entanglement fibers hydroentangled with an elastomeric material are known in the art. Examples of such elastic composite members are disclosed in, for example, U.S. Patent No. 4,775,579 entitled "Hydroentangled Elastic and Nonelastic Filaments" issued to Hagy et al. on October 4, 1988; and U.S. Patent No. 5,334,446 entitled "Composite Elastic Nonwoven Fabric" issued to Quantrille et al. on August 2, 1994. Since the entanglement fibers are hydroentangled with the elastomeric material (i.e., the entanglement fibers do not form a layered structure), the composite members can more easily avoid the separation issue caused by the stress generated in the use of disposable articles, compared with elastic laminates. However, those composite members tend to be less extensible since the entanglement fibers tend to reduce the ability of elongation of the elastomeric material. This tends to hurt expected performance of disposable articles (e.g., an elastic elongation ability).

One example of disposable articles is a disposable garment. Infants and other incontinent individuals wear disposable garments such as diapers to receive and contain

urine and other body exudates. Such disposable garments often use an elastic member. For example, ear panels and/or waistbands of disposable garments preferably include an elastic member. The performance of the elastic member is important since the ear panels and/or waistbands contribute to provide a better fit to the wearer's waist area.

In disposable pull-on garments, in particular, the performance of the elastic member also tends to impact on an ease of application. For example, if the elastic elongation ability of the ear panels and/or waistbands are very limited, the user who wants to apply the pull-on garment has (or at least feels) a difficulty to make a suitable size of waist opening by fingers. Examples of pull-on garments are disclosed, for example, in U.S. Patent No. 5,171,239 to Igaue et al., U.S. Patent No. 4,610,681 to Strohbeen et al., WO 93/17648 published on September 16, 1993, U.S. Patent No. 4,940,464 to Van Gompel et al., U.S. Patent No. 5,246,433 to Hasse et al., and U.S. Patent No. 5,569,234 to Buell et al.

Based on the foregoing, there is a need for elastic composite members which have a minimum influence by entanglement fibers on their elongation ability. There is also a need for disposable articles which use such elastic composite members.

SUMMARY

The present invention is directed to an elastic composite member which is elastically extensible in at least one direction. The elastic composite member comprises a plane elastomeric material having a plurality of apertures formed therein; and a fibrous material including entanglement fibers. The entanglement fibers are hydroentangled with the plane elastomeric material through the apertures. The fibrous material has a Strain Resistance (SRE) of less than about 100% at 100% elongation in the extensible direction.

The present invention is also directed to a disposable article including the elastic composite member.

The foregoing answers the need for elastic composite members which have a minimum influence by entanglement fibers on their elongation ability. The foregoing also answers the need for disposable garments which use such elastic composite members.

These and other features, aspects, and advantages of the present invention will become evident to those skilled in the art from reading of the present disclosure.

BRIEF DESCRIPTION OF THE DRAWINGS

While the specification concludes with claims particularly pointing out and distinctly claiming the invention, it is believed that the invention will be better understood from the following description of preferred embodiments which is taken in conjunction with the accompanying drawings and which like designations are used to designate substantially identical elements, and in which:

Fig. 1 is a perspective view of a plane elastomeric material employed in preferred embodiments of the present invention;

Fig. 2 is a graph showing an example of the two-cycles of hysteresis curves of a plane elastomeric material, in a preferred embodiment;

Fig. 3 is a perspective view of an elastic composite member which is one preferred embodiment of the present invention;

Fig. 4 is a perspective view of an elastic composite member which is another preferred embodiment of the present invention;

Fig. 5 is a schematic representation of a pressure application device for forming a flattened elastic composite member;

Fig. 6 is a perspective view of one embodiment of the disposable garment of the present invention in a typical in use configuration;

Fig. 7 is a perspective view of another preferred embodiment of the disposable garment of the present invention in a typical in use configuration;

Fig. 8 is a simplified plan view of the embodiment shown in Fig. 7 in its flat uncontracted condition showing the various panels or zones of the garment;

Fig. 9 is a cross-sectional view of a preferred embodiment taken along the section line 9-9 of Fig. 8;

Fig. 10 is a cross-sectional view of a waistband 50 of a preferred embodiment taken along the section line 10-10 of Fig. 8;

Fig. 11 is a cross-sectional view of a waistband 50 of another preferred embodiment;

Figs. 12 and 13 are schematic diagrams explaining the test method for measuring Surface Roughness values of elastic composite members;

Fig. 14 is a cross-sectional view of a steel plate used for measuring Surface Roughness values of elastic composite members; and

Fig. 15 is a graph showing a deviation of the surface of elastic composite members obtained by a measurement.

DETAILED DESCRIPTION

All cited references are incorporated herein by reference in their entireties. Citation of any reference is not an admission regarding any determination as to its availability as prior art to the claimed invention.

Herein, "comprise" means that other element(s) and step(s) which do not affect the end result can be added. These terms encompass the terms "consisting of" and "consisting essentially of".

Herein, "plane elastomeric material" refers to elastomeric materials which continuously extend in two dimensional directions. The plane elastomeric material has a first surface and a second surface opposing the first surface.

Herein, "extensible" and "elongatable" refer to materials that are capable of extending in at least one direction to a certain degree without undue rupture.

Herein, "elasticity", "elastically extensible" and "elastically elongatable" refer to extensible or elongatable materials that have the ability to return to approximately their original dimensions after the force that extended the material is removed.

Herein, "disposable" describes garments which are not intended to be laundered or otherwise restored or reused as a garment (i.e., they are intended to be discarded after a single use and, preferably, to be recycled, composted or otherwise disposed of in an environmentally compatible manner).

Herein, "pull-on garment" refers to articles of wear which have a defined waist opening and a pair of leg openings and which are pulled onto the body of the wearer by inserting the legs into the leg openings and pulling the article up over the waist.

Herein, "pull-on diaper" refers to pull-on garments generally worn by infants and other incontinent individuals to absorb and contain urine and feces. It should be understood, however, that the present invention is also applicable to other pull-on garments such as training pants, incontinent briefs, feminine hygiene garments or panties, and the like.

Herein, "panel" denotes an area or element of the pull-on garment. (While a panel is typically a distinct area or element, a panel may coincide (functionally correspond) somewhat with an adjacent panel.)

Herein, "joined" or "joining" encompasses configurations whereby an element is directly secured to another by affixing the element directly to the other element, and configurations whereby the element is indirectly secured to the other element by affixing the element to intermediate member(s) which in turn are affixed to the other element.

Herein, "uncontracted state" is used to describe states of pull-on garments in its unseamed (i.e., seams are removed), flat and relaxed condition wherein all elastic materials used are removed therefrom.

Fig. 1 is a perspective view of a plane elastomeric material 520 used in one preferred embodiment of the present invention. The plane elastomeric material 520 has a first surface 401 and a second surface 402 opposing the first surface 401. The plane elastomeric material 520 of the present invention has a plurality of apertures 530 formed therein. The apertures 530 formed in the plane elastomeric material 520 can be any shape and size as long as the entanglement fibers can be hydroentangled with the plane elastomeric material 520 through the apertures 530. Preferred shapes of the apertures 530 include a circle, an ellipse, a triangle, a quadrilateral including a rectangle, a square and a trapezoid, and the other polygons.

In a preferred embodiment, the average aperture area of one aperture 530 is from about 1 mm^2 to about 25 mm^2, more preferably from about 3 mm^2 to about 10 mm^2. Preferably, the ratio of the total area of the apertures 530 on the first surface 401 (for example) to the surface area of the first surface 401 is from about 10% to about 90%, more preferably from about 40% to about 60%.

The plane elastomeric material 520 may take any shape which can be suitably provided in products. Preferred shapes of a plane elastomeric material 520 include a quadrilateral including a rectangle and a square, a trapezoid, and the other polygons.

The plane elastomeric material 520 of the present invention is elastically extensible in at least one direction (first direction). For example, the plane elastomeric material 520 shown in Fig. 1 is elastically extensible in the structural direction D. Herein, "structural

direction" (e.g., D and B) is intended to mean a direction which extends substantially along and parallel to the plane of the plane elastomeric material 520. In a preferred embodiment, the plane elastomeric material 520 is also elastically extensible in the second direction which is perpendicular to the first direction. The direction which has the highest elongation ability in the plane of the plane elastomeric material 520 is called hereinafter as "primary extensible direction". In a preferred embodiment, the plane elastomeric material 520 shown in Fig. 1 has the primary extensible direction in the structural direction D.

The elastomeric material used in the plane elastomeric material may include all suitable elastic materials known in the art. Elastomeric materials suitable for use herein include synthetic or natural rubber materials known in the art. Preferred elastomeric materials include the diblock and triblock copolymers based on polystyrene and unsaturated or fully hydrogenerated rubber bolcks, and their blends with other polymers such as polystyrene polymers.

In a preferred embodiment, the elastomeric material contains from about 30 wt% to about 95 wt% of polystyrene, more preferably from about 50 wt% to about 85 wt% of polystyrene. Preferably, the elastomeric material is made from a polystyrene thermoplastic elastomer including styrene block copolymer based materials. Preferred styrene block copolymer based materials contain from about 1 wt% to about 70 wt% of polystyrene, more preferably from about 10 wt% to about 50 wt% of polystyrene. A preferred polystyrene thermoplastic elastomer is selected from the group consisting of a styrene-butadiene-styrene thermoplastic elastomer, a styrene-isopren-styrene thermoplastic elastomer, a styrene-ethylene/butylene-styrene thermoplastic elastomer, a styrene-ethylene/propylene-styrene thermoplastic elastomer, an unsaturated styrene butadiene rubber or a fully hydrogenated styrene butadiene rubber, a mixture thereof, and their blends with other polymers such as polyethylene polymers.

In a preferred embodiment, the plane elastomeric material 520 has a basis weight from about 30 g/m^2 to about 250 g/m^2, preferably from about 60 g/m^2 to about 200 g/m^2, and more preferably from about 100 g/m^2 to about 160 g/m^2.

In one embodiment, the plane elastomeric material 520 is a perforated film (not shown in Figs.) formed by an elastomeric material. The perforated film has a multiplicity of

apertures 530 formed therein. In a preferred embodiment, the plane elastomeric material 520 is in the form of a scrim as shown in Fig. 1.

Fig. 1 shows an elastomeric scrim 560 which are employed in preferred embodiments of the present invention. The elastomeric scrim 560 includes a plurality of first strands 125 which intersect or cross (with or without bonding to) a plurality of second strands 127 at nodes 128 at a predetermined angle α, thereby forming a net-like open structure having a plurality of apertures 530. Each aperture 530 is defined by at least two adjacent first strands 125 and at least two adjacent second strands 127 such that apertures 530 are substantially rectangular in shape. Other aperture configurations, such as parallelograms or circular arc segments, can also be provided. Such configurations could be useful for providing non-linear elastic structural directions. Preferably, the first strands 125 are substantially straight and substantially parallel to one another; and, more preferably, the second strands 127 are also substantially straight and substantially parallel to one another. More preferably, first strands 125 intersect second strands 127 at nodes 128 at a predetermined angle α of about 90 degrees. Each node 128 is an overlaid node, wherein first strands 125 and second strands 127 are preferably joined or bonded (although it is contemplated that joining or bonding may not be required) at the point of intersection with the strands still individually distinguishable at the nodes 128. However, it is believed that other node configurations such as merged or a combination of merged and overlaid would be equally suitable.

Although it is preferred that first and second strands 125 and 127 be substantially straight, parallel, and intersect at an angle α of about 90 degrees, it is noted that first and second strands 125 and 127 can intersect at other angles α, and that first strands 125 and/or second strands 127 can be aligned in circular, elliptical or otherwise nonlinear patterns relative to one another. Although for ease of manufacture it is contemplated that first strands 125 and second strands 127 have a substantially circular cross-sectional shape (prior to application of a pressure for forming a flattened elastic composite member as shown in Fig. 5), the first and second strands 125 and 127 can also have other cross-sectional shapes such as elliptical, square, triangular or combinations thereof.

Preferably, the material for the first strands 125 is chosen so that the first strands 125 can maintain the second strands 127 in relative alignment prior to forming an elastic composite member. It is also desirable that the materials for the first and second strands 125 and 127 are capable of being deformed (or initially formed) into predetermined shapes upon application of a predetermined pressure or a pressure in combination with a heat flux prior to forming an elastic composite member. These deformed shapes (e.g., elliptical second strands, substantially flat first strands and the like) can provide an elastic composite member which can be comfortably worn about the body without irritation or other discomfort.

In a preferred embodiment, the first strands 125 of the elastomeric scrim 560 have an average cross sectional area of from about 0.0001 mm^2 to about 0.5 mm^2, and the second strands 127 have an average cross sectional area of from about 0.01 mm^2 to about 2.5 mm^2. More preferably, the first strands 125 have an average cross sectional area of from about 0.0025 mm^2 to about 0.1 mm^2, and the second strands 127 have an average cross sectional area of from about 0.1 mm^2 to about 1 mm^2.

In a preferred embodiment, the elastomeric scrim 560 has from about 5 to about 20 elastic strands per inch (about 2-8 strands/cm) in the structural direction B (i.e., the first strands 125) and from about 3 to about 15 elastic strands per inch (about 1-6 strands/cm) in the structural direction D (i.e., the second strands 127). More preferably, the elastomeric scrim 560 has from about 10 to about 15 elastic strands per inch (about 4-6 strands/cm) in the structural direction B and from about 5 to about 10 elastic strands per inch (about 2-4 strands/cm) in the structural direction D.

In a preferred embodiment, the first and second strands 125 and 127 are formed from an identical elastomeric material. For example, the first and second strands 125 and 127 are formed from an identical polystyrene thermoplastic elastomer which is selected from the group consisting of a styrene-butadiene-styrene thermoplastic elastomer, a styrene-isopren-styrene thermoplastic elastomer, a styrene-ethylene/butylene-styrene thermoplastic elastomer, a styrene-ethylene/propylene-styrene thermoplastic elastomer, a fully hydrogenated styrene butadiene rubber or an unsaturated styrene butadiene rubber, and their blends with other polymers such as polystyrene polymers. A preferred elastomeric scrim

124 which containes a styrene-butadiene-styrene thermoplastic elastomer is manufactured by the Conwed Plastics Company (Minneapolis, Minn., U.S.A.) under the designation XO2514. This material also has about 12 elastic strands per inch (about 5 strands/cm) in the structural direction B (i.e., the first strands 125) and about 7 elastic strands per inch (about 3 strands/cm) in the structural direction D (i.e., the second strands 127).

Alternatively, the first and second strands 125 and 127 are formed from two different material. For example, one of the first and second strands 125 and 127 is formed from one of the above described polystyrene thermoplastic elastomer, while the other of the first and second strands 125 and 127 is formed from material(s) other than the above described polystyrene thermoplastic elastomer. Such other material(s) may be either elastic or non-elastic, and selected from suitable materials known in the art.

Fig. 2 shows one preferred example of the extension and recovery force curves for the two cycle hysteresis of the plane elastomeric material 520 (e.g., an elastomeric scrim 560). The curve E1 shows the extension force in the first cycle, while the curve R1 shows the recovery force in the first cycle. The curve E2 (shown in dashed lines) shows the extension force in the second cycle, while the curve R2 shows the recovery force in the second cycle. (These extension and recovery properties are measured as follows: In the first cycle, the plane elastomeric material 520 is subjected to an initial extension force at a crosshead rate of about 51 cm/min (about 20 in/min) at about 23°C and held for about 30 seconds at 200% extension. The plane elastomeric material 520 is then allowed to relax at the same rate to the original state (i.e., 0% extension). The plane elastomeric material 520 is allowed to remain unconstrained for one minute before being subjected to a second extension force (for the second cycle) at the same rate and conditions.

Fig. 3 is a perspective view showing an elastic composite member of one preferred embodiment of the present invention. Referring to Fig. 3, the elastic composite member 500 includes the plane elastomeric material 520 having the apertures 530 (not shown in Fig. 3 but Fig. 1), and a fibrous material 540 including entanglement fibers 550. The entanglement fibers 550 are hydroentangled one another and with the plane elastomeric material 520 through the apertures 530. The entanglement fibers 550 are depicted only in a part of the elastic composite member 500 in Fig. 3 (and also in Fig. 4). The elastic

composite member 500 has a first surface 501 and a second surface 502 opposing the first surface 501.

In a preferred embodiment, the plane elastomeric material 520 is an elastomeric scrim 560 such as shown in Fig. 1. In the embodiment shown in Fig. 3, the first surface 501 of the elastic composite member 500 has upheaval portions 511 which are upheaved by the first strands 125, and upheaval portions 512 which are upheaved by the second strands 127. Similarly, the second surface 502 of the elastic composite member 500 has also upheaval portions (not shown in Fig. 3) which are upheaved by the first and second strands 125 and 127.

The elastic composite member 500 of the present invention is elastically extensible in at least one direction (first direction). For example, the elastic composite member 500 shown in Fig. 3 is elastically extensible in the structural direction D. In a preferred embodiment, the elastic composite member 500 is also elastically extensible in the second direction which is perpendicular to the first direction. For example, the elastic composite member 500 shown in Fig. 3 is also elastically extensible in the structural direction B. In a preferred embodiment, the elastic composite member 500 shown in Fig. 3 has the primary extensible direction in the structural direction D.

The entanglement fibers 550 are hydroentangled one another. The entanglement fibers 550 are also hydroentangled with the plane elastomeric material 520 through the apertures 530. Such an entanglement fiber structure can be formed by any fiber hydroentanglement process known in the art. Preferred hydroentanglement processes are described in, for example, U.S. Patent No. 4,775,579 entitled "Hydroentangled Elastic and Nonelastic Filaments" issued to Hagy et al. on October 4, 1988; and U.S. Patent No. 5,334,446 entitled "Composite Elastic Nonwoven Fabric" issued to Quantrille et al. on August 2, 1994.

In a preferred embodiment, the entanglement fibers 550 are hydroentangled one another uniformly in adjacent apertures 530 of the plane elastomeric material 520. Herein, "uniformly" is used to describe hydroentangled fibers disposed in adjacent apertures have substantially same in terms of the average void volume of the fibrous material formed by the entanglement fibers. Herein, "substantially same" means the deviation of physical

amount (e.g., the void volume) of a material is within about 40%, more preferably about 20% of the total amount.

In a preferred embodiment, the fibrous material 540 has a basis weight from about 5 g/m^2 to about 100 g/m^2, more preferably from about 20 g/m^2 to about 80 g/m^2, and yet more preferably from about 30 g/m^2 to about 60 g/m^2.

Any type of fibers can be used for the entanglement fibers 550 of the present invention. For example, natural fibers (e.g., wool and cotton fibers), synthetic fibers (e.g., polyolefin, polyester, nylon, and rayon fibers), or a mixture of natural fibers and/or synthetic fibers can be used as the entanglement fibers. For ease of manufacture and cost efficiency, synthetic staple fibers are preferably used. More preferably, such synthetic staple fibers are formed from a polyolefin (e.g., polyethylene and polypropylene) or a polyester. Preferred polyester material includes a polyethylene terephthalate, a polypropylene terephthalate and a polybutylene terephthalate, or mixtures thereof.

In one embodiment, the individual entanglement fibers 550 are formed from a single material which is selected from the above materials (i.e., the individual fiber is not made from two or more materials). Alternatively, the entanglement fibers 550 may be formed from a mixture of two (or more) materials which are selected from the above materials.

In a preferred embodiment, the entanglement fibers 550 are bi-component fibers. Preferably, the entanglement fibers 550 have a bi-component fiber structure formed by two distinct materials, for example, a side-by-side cross section or an eccentric cross section. In a preferred embodiment, the bi-component fibers have a side-by-side cross section of a lower molecular weight polyethylene terephthalate and a higher molecular weight polyethylene terephthalate. In an alternative preferred embodiment, the bi-component fibers have an eccentric cross section of a polypropylene and a random polypropylene/polyethylene copolymer which preferably contains less than 15% of polyethylene.

Preferably, the entanglement fibers 550 have an average fiber thickness of less than about 4 denier per filament. More preferably, the entanglement fibers 550 have an average fiber thickness of more than about 0.5 denier per filament. Yet more preferably, the

entanglement fibers 550 have an average fiber thickness of from about 1 to about 2.5 denier per filament.

In a preferred embodiment, the entanglement fibers 550 have an average fiber length of from about 1 cm to about 10 cm. More preferably, the entanglement fibers 550 have an average fiber length of from about 3 cm to about 7 cm. Yet more preferably, the entanglement fibers 550 have an average fiber length of from about 4 cm to about 6 cm.

In a preferred embodiment, the elastic composite member 500 has a stress at 100% elongation of from about 50 gf/inch (about 20 gf/cm) to about 500 gf/inch (about 200 gf/cm), preferably from about 150 gf/inch (about 60 gf/cm) to about 350 gf/inch (about 140 gf/cm), and more preferably from about 200 gf/inch (about 80 gf/cm) to about 300 gf/inch (about 120 gf/cm).

The fibrous material 540 of the present invention has a Strain Resistance (SRE) of less than about 100% at 100% elongation in the extensible direction. In the embodiment shown in Fig. 3, the extensible direction can be either the structural direction D or B (preferably, D). SRE is a physical property of entanglement fibers (i.e., a fibrous material) which are hydroentangled one another and with a plane elastomeric material in an elastic composite member. SRE of a fibrous material at a designated elongation in an extensible direction is obtained from the following expression:

$$SRE = (TSC - TSE) / TSE \times 100 \ (\%)$$

wherein,

TSC : average tensile strength of elastic composite member at the designated elongation; and

TSE : average tensile strength of plane elastomeric material at the designated elongation.

The SRE value shows a degree of resistance of the fibrous material when the elastic composite member is elongated to a designated elongation (e.g., 100% of the original length) especially in the first several times before the use of disposable articles. For example, a fibrous material 540 which has a relatively higher value of SRE requires a relatively higher force to elongate the elastic composite member 500. Such a fibrous material 540 tends to hurt an expected performance of disposable articles using the elastic

composite member. A method for measuring the tensile strength of elastic composite members and plane elastomeric materials is described in the "Test Methods" section.

In a preferred embodiment, the fibrous material 540 has an SRE of less than about 60%, and more preferably less than about 30% at 100% elongation in the extensible direction. In an alternative preferred embodiment, the fibrous material 540 has an SRE of less than about 30%, and more preferably less than about 20% at 50% elongation in the extensible direction.

Preferred elastic composite members 500 are obtainable from Daiwabo Co., Ltd., Osaka, Japan, under Code Nos. PC160A; PC160B; PC170B and PC170C. The fibrous materials 540 of these elastic composite members 500 have the following SRE values at 50% and 100% elongation in the cross-machine direction (CD).

Table I

Sample No.	Sample Code	Stain Resistance (%)	
		50% Elongation	100% Elongation
1	PC160A	19	43
2	PC160B	26	57
3	PC170B	23	48
4	PC170C	14	20

Fig. 4 is a perspective view of an elastic composite member 600 which is another preferred embodiment of the present invention. Referring to Fig. 4, the elastic composite member 600 includes the plane elastomeric material 520 having the apertures 530 (not shown in Fig. 4), and a fibrous material 540 including entanglement fibers 550. The entanglement fibers 550 are hydroentangled one another and with the plane elastomeric material 520 through the apertures 530. The entanglement fibers 550 are depicted only in a part of the elastic composite member 600. The elastic composite member 600 has a first surface 501 and a second surface 502 opposing the first surface 501.

In a preferred embodiment, the plane elastomeric material 520 is an elastomeric scrim 560 such as shown in Fig. 1. Compared with the embodiment shown in Fig. 3, the elastic composite member 600 has lower upheaval portions 511' and 512' which are

upheaved by the first and second strands 125 and 127 on the first and second surfaces 501 and 502.

The elastic composite member 600 is elastically extensible in at least one direction (first direction). For example, the elastic composite member 600 shown in Fig. 4 is elastically extensible in the structural direction D. In a preferred embodiment, the elastic composite member 600 is also elastically extensible in the second direction which is perpendicular to the first direction. For example, the elastic composite member 600 shown in Fig. 4 is also elastically extensible in the structural direction B. In a preferred embodiment, the elastic composite member 600 shown in Fig. 4 has the primary extensible direction in the structural direction D.

In the embodiment shown in Fig. 4, the elastic composite member 600 has a Surface Roughness (SRO) of less than about 10 μm. SRO is a physical property of an elastic composite member. The SRO shows a degree of deviation of the surfaces of the elastic composite member. For example, an elastic composite member 600 which has a relatively higher value of SRO increases the possibility of causing a red marking on the wearer's skin when the wearer puts on a disposable article using such an elastic composite member. This is because if an elastic composite member has a rough surface (i.e., convex potions and concave portions in the first surface 501 (or the second surface 502), forces which are generated by the elastic composite member 600 and are directed to the skin of the wearer are concentrated at the convex portions. It is believed that such concentration of the forces cause the red marking problem. A method for defining the SRO of elastic composite members is described in the "Test Methods" section.

In a preferred embodiment, the elastic composite member 600 has an SRO of less than about 8 μm, more preferably less than about 5 μm.

A preferred elastic composite member 600 which has a relatively lower SRO is formed by applying a predetermined pressure at a predetermined temperature to a precursor elastic composite member for a predetermined time period. Herein, "precursor elastic composite member" can be any of the above described elastic composite members 500. The resulting elastic composite member 600 is referred to as "flattened elastic composite member" hereinafter.

In a preferred embodiment, the predetermined temperature is lower than the melting point of the fibrous material. In a more preferred embodiment wherein the plane elastomeric material 520 includes soft segments and hard segments, the predetermined temperature is higher than the glass transition temperature of the hard segments.

Fig. 5 shows one preferred example of a pressure application device 800 for forming a flattened elastic composite member. Any of the above described elastic composite members 500 can be used as a precursor elastic composite member 810 for forming a flattened elastic composite member 820. Referring to Fig. 5, the pressure application device 800 includes a first pressure plate 801 having a first surface 803, and a second plate 802 having a second surface 804. The second pressure plate 802 is fixed, while the first pressure plate 801 is movable to apply a pressure P to the precursor elastic composite member 810 in cooperation with the second pressure plate 802. Preferably, the first and second surfaces 803 and 804 are substantially plane and are substantially parallel each other. The elastic composite member 810 is manually supplied to the pressure application device 800. A preferred pressure application device 800 is available from Toyo Tester Industry Co., Ltd., Osaka, Japan, under a trade name "Heat Sealer".

In the pressure application process, the first surface 803 of the elastic composite member 810 is heated to a temperature T1, while the second surface 804 is heated to a temperature T2. Preferably, the temperatures T1 and T2 are selected within a predetermined range so that any of the entanglement fibers 550 can not be melted at the pressure P. This is preferred because a melting of the entanglement fibers 550 tends to increase the SRE value of the resulting flattened elastic composite member 820. Additionally, by avoiding such a melting of any of the entanglement fibers 550, it is possible to maintain the ability of the elongation of the resulting flattened elastic composite member 820 within a preferred range.

In preferred embodiments wherein the above described elastic composite members 500 (Code Nos. PC160A; PC160B; PC170B and PC170C) are used as precursor elastic composite members 810, the temperature T1 is from about 80°C to about 160°C, more preferably from about 90°C to about 110°C. The temperature T2 is preferably from about 40°C to about 65°C, more preferably from about 50°C to about 60°C. The pressure P is preferably from about 6 kg/cm^2 to about 15 kg/cm^2, more preferably from about 9 kg/cm^2

to about 11 kg/cm^2. The time period of the application of the pressure P is preferably from about 1 second to about 20 seconds, more preferably from about 5 seconds to about 15 seconds. Preferably, the application of pressure P can be performed twice (or more times) to decrease the SRO value of the resulting elastic composite member 820. By the application of the temperatures T1 and T2 at the pressure P, the precursor elastic composite member 810 (i.e., the plane elastomeric material 520 as well as the fibrous material 540) is flattened to decrease the SRO value compared with that of the precursor elastic composite member 810 (e.g., the elastic composite member 500 shown in Fig. 3).

The resulting flattened elastic composite members 820 have the following SRO values in the machine direction (MD) which are relatively higher than those in the cross-machine direction (CD). (The below table also shows the SRO values of the precursor elastic composite members before the flattening formation for reference purpose.)

Table II

Sample No.	Sample Code	Surface Roughness (μm) (before flattening)	Surface Roughness (μm) (after flattening)
1	PC160A	7.9	4.3
2	PC160B	7.1	4.0
3	PC170B	4.4	3.9
4	PC170C	4.1	2.7

The elastic composite member of the present invention can be incorporated into a variety of products wherein it is desired to provide an elastic elongation ability in at least one structural direction either partially or entirely. Examples of such products include disposable articles, including sweat bands, bandages, body wraps, and disposable garments including disposable diapers and incontinence products. In the following, applications to disposable pull-on garments are described as preferred embodiments of the present invention. One or more of the above described elastic composite members will be preferably used as, for example, the elastic members 70 and 700 shown in Figs. 9, 10 and 11.

Fig. 6 shows one preferred embodiment of a disposable pull-on garment of the present invention (i.e., a unitary disposable pull-on diaper 120). Referring to Fig. 6, the disposable pull-on garment 120 has a front region 26; a back region 28 and a crotch region 30 between the front region 26 and the back region 28. A chassis 41 is provided in the front, back and crotch regions 26, 28 and 30. The chassis 41 includes a liquid pervious topsheet 24, a liquid impervious backsheet 22 associated with the topsheet 24, and an absorbent core 25 (not shown in Fig. 6) disposed between the topsheet 24 and the backsheet 22. The chassis 41 has side edges 220 which form edge lines 222 in the front region 26.

The pull-on garment 120 further includes at least one pair of extensible ear panels 45 each extending laterally outward from the corresponding sides of the chassis 41. Each of the ear panels 45 has an outermost edge 240 which forms an outermost edge line 242. At least one of the outermost edge lines 242 has a nonuniform lateral distance from the longitudinal center line 100 (not shown in Fig. 6) in the uncontracted state of the garment 120.

In a preferred embodiment, the ear panels 45 continuously extend from the corresponding sides of the chassis 41 in the back region 28 to the corresponding side edges 220 of the chassis 41 in the front region 26 as shown in Fig. 6. Alternatively, the ear panels 45 may continuously extend from the corresponding sides of the chassis 41 in the front region 26 to the corresponding side edges of the chassis 41 in the back region 28 (not shown in Fig. 6).

The pull-on garment 120 has the ear panels 45 joined to the chassis 41 to form two leg openings 34 and a waist opening 36. Preferably, the pull-on garment 120 further includes seams 232 each joining the chassis 41 and the ear panels 45 along the corresponding edge lines 222 and 242 to form the two leg openings 34 and the waist opening 36.

Fig. 7 shows another preferred embodiment of a disposable pull-on garment of the present invention (i.e., a unitary disposable pull-on diaper 20). Referring to Fig. 7, the disposable pull-on garment 20 includes a pair of extensible front ear panels 46 each extending laterally outward from the corresponding sides of the chassis 41 in the front region 26, and a pair of extensible back ear panels 48 each extending laterally outward from

the corresponding sides of the chassis 41 in the back region 28. Each of the ear panels 46 and 48 has an outermost edge 240 which forms an outermost edge line 242. At least one of the outermost edge lines 242 has a nonuniform lateral distance LD from the longitudinal center line 100 (not shown in Fig. 7 but in Fig. 8) in the uncontracted state of the garment 20. The pull-on garment 20 further includes seams 32 each joining the front and back ear panels 46 and 48 along the corresponding edge lines 242 to form the two leg openings 34 and the waist opening 36.

In a preferred embodiment, at least one of, more preferably both of, the pairs of the ear panels 45, 46 and 48 are elastically extensible in at least the lateral direction. In one embodiment, the ear panels 45, 46 and 48 are also elastically extensible in the longitudinal direction. The elastically extensible ear panels 45, 46 and 48 provide a more comfortable and contouring fit by initially conformably fitting the pull-on garment to the wearer and sustaining this fit throughout the time of wear well past when the pull-on garment has been loaded with exudates since the ear panels 45, 46 and/or 48 allow the sides of the pull-on garment to expand and contract.

The ear panels 45, 46 and 48 may be formed by unitary elements of the pull-on garment 20 or 120 (i.e., they are not separately manipulative elements secured to the pull-on garment 20 or 120, but rather are formed from and are extensions of one or more of the various layers of the pull-on garment). In a preferred embodiment, each of the ear panels 45, 46 and 48 is a projected member of the chassis 41 (more clearly shown in Fig. 8). Preferably, the ear panels 45, 46 and 48 include at least one unitary element or a continuous sheet material (e.g. the nonwoven outer cover 74 in Fig. 9) that forms a part of the chassis 41 and continuously extends into the ear panels 45, 46 and 48. Alternatively, the ear panels 45, 46 and 48 may be discrete members (not shown in Figs.) which do not have any unitary element that forms a part of the chassis 41, and may be formed by joining the discrete members to the corresponding sides of the chassis 41.

In a preferred embodiment, the pull-on garment 20 or 120 further includes seam panels 66 each extending laterally outward from each of the ear panels 45, 46 and 48; and tear open tabs 31 each extending laterally outward from the seam panel 66. In a preferred embodiment, each of the seam panels 66 is an extension of the corresponding ear panels 45,

46 and 48, or at least one of the component elements used therein, or any other combination of the elements. More preferably, each of the tear open tabs 31 is also an extension of the corresponding seam panel 66 or at least one of its component elements used therein, or any other combination of its elements.

In a preferred embodiment, the corresponding edge portions of the chassis 41 and/or the ear panels 45, 46 and 48 are seamed directly or indirectly (e.g., through the seam panels 66), in an overlaping manner to make an overlapped seam structure. Alternatively, the front and ear panels 46 and 48 can be seamed in a butt seam manner (not shown in Figs.). The bonding of the seams 32 can be performed by any suitable means known in the art appropriate for the specific materials employed in the chassis 41 and/or the ear panels 45, 46 and 48. Thus, sonic sealing, heat sealing, pressure bonding, adhesive or cohesive bonding, sewing, autogeneous bonding, and the like may be appropriate techniques. Preferably, the seam panels 66 are joined by a predetermined pattern of heat/pressure or ultrasonic welds which withstands the forces and stresses generated on the garment 20 or 120 during wear.

A continuous belt 38 is formed by the ear panels 45, 46 and 48, and a part of the chassis 41 about the waist opening 36 as shown in Figs. 6 and 7. Preferably, elasticized waist bands 50 are provided in both the front region 26 and the back region 28. The continuous belt 38 acts to dynamically create fitment forces in the pull-on garment 20 or 120 when positioned on the wearer, to maintain the pull-on garment 20 or 120 on the wearer even when loaded with body exudates thus keeping the absorbent core 25 (not shown in Fig. 7) in close proximity to the wearer, and to distribute the forces dynamically generated during wear about the waist thereby providing supplemental support for the absorbent core 25 without binding or bunching the absorbent core 25.

Fig. 8 is a partially cut-away plan view of the pull-on garment 20 of Fig. 7 in its uncontracted state (except in the ear panels 46 and 48 which are left in their relaxed condition) with the topsheet 24 facing the viewer, prior to the ear panels 46 and 48 being joined together by the seams 32. The pull-on garment 20 has the front region 26, the back region 28 opposed to the front region 26, the crotch region 30 positioned between the front region 26 and the back region 28, and a periphery which is defined by the outer perimeter or edges of the pull-on garment 20 in which the side edges are designated 150 and 240, and the

end edges or waist edges are designated 152. The topsheet 24 has the body-facing surface of the pull-on garment 20 which is positioned adjacent to the wearer's body during use. The backsheet 22 has the outer-facing surface of the pull-on garment 20 which is positioned away from the wearer's body. The pull-on garment 20 includes the chassis 41 including the liquid pervious topsheet 24, the liquid impervious backsheet 22 associated with the topsheet 24, and the absorbent core 25 positioned between the topsheet 24 and the backsheet 22. The garment 20 further includes the front and back ear panels 46 and 48 extending laterally outward from the chassis 41, the elasticized leg cuffs 52, and the elasticized waistbands 50. The topsheet 24 and the backsheet 22 have length and width dimensions generally larger than those of the absorbent core 25. The topsheet 24 and the backsheet 22 extend beyond the edges of the absorbent core 25 to thereby form the side edges 150 and the waist edges 152 of the garment 20. The liquid impervious backsheet 22 preferably includes a liquid impervious plastic film 68.

The pull-on garment 20 also has two centerlines, a longitudinal centerline 100 and a transverse centerline 110. Herein, “longitudinal" refers to a line, axis, or direction in the plane of the pull-on garment 20 that is generally aligned with (e.g. approximately parallel with) a vertical plane which bisects a standing wearer into left and right halves when the pull-on garment 20 is worn. Herein, "transverse" and "lateral" are interchangeable and refer to a line, axis or direction which lies within the plane of the pull-on garment that is generally perpendicular to the longitudinal direction (which divides the wearer into front and back body halves). The pull-on garment 20 and component materials thereof also have a body-facing surface which faces the skin of wearer in use and an outer-facing surface which is the opposite surface to the body-facing surface.

Each of the ear panels 45, 46 and 48 has the outermost edge line 242. Herein, “edge line” refers to lines which define the outlines of the ear panels 45, 46 and 48 or the chassis 41. Herein, “outermost” refers to portions which are farthest from the longitudinal centerline 100. At least one of the edge lines 242 has a nonuniform lateral distance LD from the longitudinal center line 100 in the uncontracted state of the garment 20.

While the topsheet 24, the backsheet 22, and the absorbent core 25 may be assembled in a variety of well known configurations, exemplary chassis configurations are

described generally in U.S. Patent 3,860,003 entitled "Contractible Side Portions for Disposable Diaper" which issued to Kenneth B. Buell on January 14, 1975; and U.S. Patent 5,151,092 entitled "Absorbent Article With Dynamic Elastic Waist Feature Having A Predisposed Resilient Flexural Hinge" which issued to Kenneth B. Buell et al., on September 29, 1992.

Fig. 9 is a cross-sectional view of a preferred embodiment taken along the section line 4-4 of Fig. 8. The pull-on garment 20 includes the chassis 41 including the liquid pervious topsheet 24, the liquid impervious backsheet 22 associated with the topsheet 24, and the absorbent core 25 positioned between the topsheet 24 and the backsheet 22. The pull-on garment 20 further includes the front ear panel 46 extending laterally outward from the chassis 41, and an inner barrier cuff 54. Although Fig. 9 depicts only the structure of the front ear panel 46 and the chassis 41 in the front region 26, preferably a similar structure is also provided in the back region 28.

In a preferred embodiment, the front ear panel 46 is formed by a lamination of an extended part 72 of the barrier flap 56, an elastic member 70 and the nonwoven outer cover 74. Any of the above described elastic composite members can be used as the elastic member 70.

The absorbent core 25 can be any absorbent member which is generally compressible, conformable, non-irritating to the wearer's skin, and capable of absorbing and retaining liquids such as urine and other certain body exudates. The absorbent core 25 may be manufactured in a wide variety of sizes and shapes (e.g., rectangular, hourglass, "T"-shaped, asymmetric, etc.) and from a wide variety of liquid-absorbent materials commonly used in disposable pull-on garments and other absorbent articles such as comminuted wood pulp which is generally referred to as airfelt. Examples of other suitable absorbent materials include creped cellulose wadding; meltblown polymers including coform; chemically stiffened, modified or cross-linked cellulosic fibers; tissue including tissue wraps and tissue laminates; absorbent foams; absorbent sponges; superabsorbent polymers; absorbent gelling materials; or any equivalent material or combinations of materials.

The configuration and construction of the absorbent core 25 may vary (e.g., the absorbent core 25 may have varying caliper zones, a hydrophilic gradient, a superabsorbent gradient, or lower average density and lower average basis weight acquisition zones; or may include one or more layers or structures). Further, the size and absorbent capacity of the absorbent core 25 may also be varied to accommodate wearers ranging from infants through adults. However, the total absorbent capacity of the absorbent core 25 should be compatible with the design loading and the intended use of the garment 20.

A preferred embodiment of the garment 20 has an asymmetric, modified hourglass-shaped absorbent core 25 having ears in the front and back waist regions 26 and 28. Other exemplary absorbent structures for use as the absorbent core 25 that have achieved wide acceptance and commercial success are described in U.S. Patent No. 4,610,678 entitled "High-Density Absorbent Structures" issued to Weisman et al. on September 9, 1986; U.S. Patent No. 4,673,402 entitled "Absorbent Articles With Dual-Layered Cores" issued to Weisman et al. on June 16, 1987; U.S. Patent No. 4,888,231 entitled "Absorbent Core Having A Dusting Layer" issued to Angstadt on December 19, 1989; and U.S. Patent No. 4,834,735, entitled "High Density Absorbent Members Having Lower Density and Lower Basis Weight Acquisition Zones", issued to Alemany et al. on May 30, 1989.

The chassis 41 may further include an acquisition/distribution core 84 of chemically stiffened fibers positioned over the absorbent core 25, thereby forming a dual core system. In a preferred embodiment, the fibers are hydrophilic chemically stiffened cellulosic fibers. Herein, “chemically stiffened fibers” means any fibers which have been stiffened by chemical means to increase stiffness of the fibers under both dry and aqueous conditions. Such means include the addition of chemical stiffening agents which, for example, coat and/or impregnate the fibers. Such means also include the stiffening of the fibers by altering the chemical structure of the fibers themselves, e.g., by cross-linking polymer chains.

The fibers utilized in the acquisition/distribution core 84 can also be stiffened by means of chemical reaction. For example, crosslinking agents can be applied to the fibers which, subsequent to application, are caused to chemically form intrafiber crosslink bonds. These crosslink bonds can increase stiffness of the fibers. Whereas the utilization of

intrafiber crosslink bonds to chemically stiffen the fibers is preferred, it is not meant to exclude other types of reactions for chemical stiffening of the fibers.

In the more preferred stiffened fibers, chemical processing includes intrafiber crosslinking with crosslinking agents while such fibers are in a relatively dehydrated, defibrated (i.e. individualized), twisted, curled condition. Suitable chemical stiffening agents include monomeric crosslinking agents including, but not limited to, C_2-C_8 dialdehydes and C_2-C_8 monoaldehydes having an acid functionality can be employed to form the cosslinking solution. These compounds are capable of reacting with at least two hydroxyl groups in a single cellulose chain or on proximately located cellulose chains in a single fiber. Such crosslinking agents contemplated for use in preparing the stiffened cellulose fibers include, but are not limited to, glutaraldehyde, glyoxal, formaldehyde, and glyoxylic acid. Other suitable stiffening agents are polycarboxylates, such as citric acid. The polycarboxylic stiffening agents and a process for making stiffened fibers from them are described in U.S. Patent No. 5,190,563, entitled "Process for Preparing Individualized, Polycarboxylic Acid crosslinked Fibers" issued to Herron, on March 2, 1993. The effect of crosslinking under these conditions is to form fibers which are stiffened and which tend to retain their twisted, curled configuration during use in the absorbent articles herein. Such fibers, and processes for making them are cited in the above incorporated patents.

Preferred dual core systems are disclosed in U.S. Patent No. 5,234,423, entitled "Absorbent Article With Elastic Waist Feature and Enhanced Absorbency" issued to Alemany et al., on August 10, 1993; and in U.S. Patent No. 5,147,345, entitled "High Efficiency Absorbent Articles For Incontinence Management" issued to Young, LaVon and Taylor on September 15, 1992. In a preferred embodiment, the acquisition/distribution core 84 includes chemically treated stiffened cellulosic fiber material, available from Weyerhaeuser Co. (U.S.A.) under the trade designation of “CMC”. Preferably, the acquisition/distribution core 84 has a basis weight of from about 40 g/m^2 to about 400 g/m^2, more preferably from about 75 g/m^2 to about 300 g/m^2.

More preferably, the chassis 22 further includes an acquisition/distribution layer 82 between the topsheet 24 and the acquisition/distribution core 84 as shown in Fig. 9. The acquisition/distribution layer 82 is provided to help reduce the tendency for surface wetness

of the topsheet 24. The acquisition/distribution layer 82 preferably includes carded, resin bonded hiloft nonwoven materials such as, for example, available as Code No. FT-6860 from Polymer Group, Inc., North America (Landisiville, New Jersey, U.S.A.), which is made of polyethylene telephthalate fibers of 6 dtex, and has a basis weight of about 43 g/m^2. A preferable example for the acquisition/distribution layer 82 and the acquisition/distribution core 84 is disclosed in EP 0797968A1 (Kurt et al.) published on October 1, 1997.

The topsheet 24 is preferably compliant, soft feeling, and non-irritating to the wearer's skin. Further, the topsheet 24 is liquid pervious permitting liquids (e.g., urine) to readily penetrate through its thickness. A suitable topsheet 24 may be manufactured from a wide range of materials such as woven and nonwoven materials; polymeric materials such as apertured formed thermoplastic films, apertured plastic films, and hydroformed thermoplastic films; porous foams; reticulated foams; reticulated thermoplastic films; and thermoplastic scrims. Suitable woven and nonwoven materials can be included of natural fibers (e.g., wool or cotton fibers), synthetic fibers (e.g., polymeric fibers such as polyester, polypropylene, or polyethylene fibers) or from a combination of natural and synthetic fibers. The topsheet 24 is preferably made of a hydrophobic material to isolate the wearer's skin from liquids which have passed through the topsheet 24 and are contained in the absorbent core 25 (i.e., to prevent rewet). If the topsheet 24 is made of a hydrophobic material, at least the upper surface of the topsheet 24 is treated to be hydrophilic so that liquids will transfer through the topsheet more rapidly. This diminishes the likelihood that body exudates will flow off the topsheet 24 rather than being drawn through the topsheet 24 and being absorbed by the absorbent core 25. The topsheet 24 can be rendered hydrophilic by treating it with a surfactant. Suitable methods for treating the topsheet 24 with a surfactant include spraying the topsheet 24 material with the surfactant and immersing the material into the surfactant. A more detailed discussion of such a treatment and hydrophilicity is contained in U.S. Patent No. 4,988,344 entitled "Absorbent Articles with Multiple Layer Absorbent Layers" issued to Reising, et al. on January 29, 1991 and U.S. Patent No. 4,988,345 entitled "Absorbent Articles with Rapid Acquiring Absorbent Cores" issued to Reising on January 29, 1991.

In a preferred embodiment, the topsheet 24 is a nonwoven web that can provide reduced tendency for surface wetness; and consequently facilitate maintaining urine absorbed by the core 25 away from the user's skin, after wetting. One of the preferred topsheet materials is a thermobonded carded web which is available as Code No. P-8 from Fiberweb North America, Inc. (Simpsonville, South Carolina, U.S.A.). Another preferred topsheet material is available as Code No. S-2355 from Havix Co., Japan. This material is a bi-layer composite material, and made of two kinds of synthetic surfactant treated bicomponent fibers by using carding and air-through technologies. Yet another preferred topsheet material is a thermobonded carded web which is available as Code No. Profleece Style 040018007 from Amoco Fabrics, Inc. (Gronau, Germany).

Another preferred topsheet 24 includes an apertured formed film. Apertured formed films are preferred for the topsheet 24 because they are pervious to body exudates and yet non-absorbent and have a reduced tendency to allow liquids to pass back through and rewet the wearer's skin. Thus, the surface of the formed film which is in contact with the body remains dry, thereby reducing body soiling and creating a more comfortable feel for the wearer. Suitable formed films are described in U.S. Patent No. 3,929,135, entitled "Absorptive Structures Having Tapered Capillaries", issued to Thompson on December 30, 1975; U.S. Patent No. 4,324,246 entitled "Disposable Absorbent Article Having A Stain Resistant Topsheet", issued to Mullane, et al. on April 13, 1982; U.S. Patent No. 4,342,314 entitled "Resilient Plastic Web Exhibiting Fiber-Like Properties", issued to Radel. et al. on August 3, 1982; U.S. Patent No. 4,463,045 entitled "Macroscopically Expanded Three-Dimensional Plastic Web Exhibiting Non-Glossy Visible Surface and Cloth-Like Tactile Impression", issued to Ahr et al. on July 31, 1984; and U.S. 5,006,394 "Multilayer Polymeric Film" issued to Baird on April 9, 1991.

In a preferred embodiment, the backsheet 22 includes the liquid impervious film 68 as shown in, for example, Fig. 9. Preferably, the liquid impervious film 68 longitudinally extends in the front, back and crotch regions 26, 28 and 30. More preferably, the liquid impervious film 68 does not laterally extend into the at least one of the ear panels 46 or 48. The liquid impervious film 68 has a body-facing surface 79 and an outer-facing surface 77. The liquid impervious film 68 is impervious to liquids (e.g., urine) and is preferably

manufactured from a thin plastic film. However, more preferably the plastic film permits vapors to escape from the garment 20. In a preferred embodiment, a microporous polyethylene film is used for the liquid impervious film 68. A suitable microporous polyethylene film is manufactured by Mitsui Toatsu Chemicals, Inc., Nagoya, Japan and marketed in the trade as PG-P. In a preferred embodiment, a disposable tape (not shown in Figs.) is additionally joined to the outer surface of the backsheet 22 to provide a convenient disposal after soiling.

A suitable material for the liquid impervious film 68 is a thermoplastic film having a thickness of from about 0.012 mm (0.5 mil) to about 0.051 mm (2.0 mils), preferably including polyethylene or polypropylene. Preferably, the liquid impervious film has a basis weight of from about 5 g/m^2 to about 45 g/m^2. However, it should be noted that other flexible liquid impervious materials may be used. Herein, "flexible" refers to materials which are compliant and which will readily conform to the general shape and contours of the wearer's body.

The nonwoven outer cover 74 is joined with the outer-facing surface of the liquid impervious film 68 to form a laminate (i.e., the backsheet 22). The nonwoven outer cover 74 is positioned at the outermost portion of the garment 20 and covers at least a portion of the outermost portion of the garment 20. In a preferred embodiment, the nonwoven outer cover 74 covers almost all of the area of the outermost portion of the garment 20. The nonwoven outer cover 74 may be joined to the liquid impervious film 68 by any suitable attachment means known in the art. For example, the nonwoven outer cover 74 may be secured to the liquid impervious film 68 by a uniform continuous layer of adhesive, a patterned layer of adhesive, or an array of separate lines, spirals, or spots of adhesive. Suitable adhesives include a hotmelt adhesive obtainable from Nitta Findley Co., Ltd., Osaka, Japan as H-2128, and a hotmelt adhesive obtainable from H.B. Fuller Japan Co., Ltd., Osaka, Japan as JM-6064.

In a preferred embodiment, the nonwoven outer cover 74 is a carded nonwoven web, for example, obtainable from Havix Co., LTD., Gifu, Japan as E-2341. The nonwoven outer cover 74 is made of bi-component fibers of a polyethylene (PE) and a polypropylene (PP). The ratio of PE/PP is about 50/50. The PE/PP bi-component fiber has the dimension

of 2d x 51 mm. Another preferred carded nonwoven web is obtainable from Chisso Corp., Moriyama, Japan. The nonwoven outer cover 74 is also made of bi-component fibers of a polyethylene (PE) and a polypropylene (PP). The ratio of PE/PP is about 50/50.

In another preferred embodiment, the nonwoven web is a spunbonded nonwoven web, for example, obtainable from Mitsui Petrochemical Industries, Ltd., Tokyo, Japan. The nonwoven web is made of bi-component fibers of a polyethylene (PE) and a polypropylene (PP). The ratio of PE/PP is about 80/20. The PE/PP bi-component fiber has the thickness is approximately 2.3d. Another spunbonded nonwoven web is obtainable from Fiberweb France S.A., under Code No. 13561 DAPP.

The backsheet 22 is preferably positioned adjacent the outer-facing surface of the absorbent core 25 and is preferably joined thereto by any suitable attachment means known in the art. For example, the backsheet 22 may be secured to the absorbent core 25 by a uniform continuous layer of adhesive, a patterned layer of adhesive, or an array of separate lines, spirals, or spots of adhesive. Adhesives which have been found to be satisfactory are manufactured by H. B. Fuller Company of St. Paul, Minnesota, U.S.A., and marketed as HL-1358J. An example of a suitable attachment means including an open pattern network of filaments of adhesive is disclosed in U.S. Patent No. 4,573,986 entitled "Disposable Waste-Containment Garment", which issued to Minetola et al. on March 4, 1986. Another suitable attachment means including several lines of adhesive filaments swirled into a spiral pattern is illustrated by the apparatus and methods shown in U.S. Patent No. 3,911,173 issued to Sprague, Jr. on October 7, 1975; U.S. Patent No. 4,785,996 issued to Ziecker, et al. on November 22, 1978; and U.S. Patent No. 4,842,666 issued to Werenicz on June 27, 1989. Alternatively, the attachment means may include heat bonds, pressure bonds, ultrasonic bonds, dynamic mechanical bonds, or any other suitable attachment means or combinations of these attachment means as are known in the art.

In an alternative embodiment, the absorbent core 25 is not joined to the backsheet 22, and/or the topsheet 24 in order to provide greater extensibility in the front region 26 and the back region 28.

The pull-on garment 20 preferably further includes elasticized leg cuffs 52 for providing improved containment of liquids and other body exudates. The elasticized leg

cuffs 52 may include several different embodiments for reducing the leakage of body exudates in the leg regions. (The leg cuffs can be and are sometimes also referred to as leg bands, side flaps, barrier cuffs, elastic cuffs or gasketing cuffs.) U.S. Patent 3,860,003 entitled "Contractable Side Portions for Disposable Diaper" issued to Buell on January 14, 1975, describes a disposable diaper which provides a contractible leg opening having a side flap and one or more elastic members to provide an elasticized leg cuff. U.S. Patent 4,909,803 entitled "Disposable Absorbent Article Having Elasticized Flaps" issued to Aziz et al. on March 20, 1990, describes a disposable diaper having "stand-up" elasticized flaps (barrier cuffs) to improve the containment of the leg regions. U.S. Patent 4,695,278 entitled "Absorbent Article Having Dual Cuffs" issued to Lawson on September 22, 1987; and U.S. Patent 4,795,454 entitled "Absorbent Article Having Leakage-Resistant Dual Cuffs" issued to Dragoo on January 3, 1989, describe disposable diapers having dual cuffs including a gasketing cuff and a barrier cuff. U.S. Patent 4,704,115 entitled "Disposable Waist Containment Garment" issued to Buell on November 3, 1987, discloses a disposable diaper or incontinence garment having side-edge-leakage-guard gutters configured to contain free liquids within the garment.

While each elasticized leg cuff 52 may be configured so as to be similar to any of the leg bands, side flaps, barrier cuffs, or elastic cuffs described above, it is preferred that the elasticized leg cuff 52 includes an elastic gasketing cuff 62 with one or more elastic strands 64 as shown in Fig. 8, which is described in the above-referred U.S. Patent Nos. 4,695,278 and 4,795,454. It is also preferred that each elasticized leg cuff 52 further includes inner barrier cuffs 54 each including a barrier flap 56 and a spacing means 58 which are described in the above-referenced U.S. Patent No. 4,795,454.

The pull-on garment 20 further includes an elasticized waistband 50 that provides improved fit and containment. The elasticized waistband 50 is that portion or zone of the pull-on garment 20 which is intended to elastically expand and contract to dynamically fit the wearer's waist. The waistband 50 includes an elastic member 700. Any of the above described elastic composite members can be used as the elastic member 700. The waistband 50 is disposed along at least one, preferably both of the end edges 152 of the disposable garment 20. The elasticized waistband 50 preferably extends longitudinally inwardly from

the end edge 152 of the pull-on garment 20 toward the waist edge 154 of the absorbent core 25. Preferably, the pull-on garment 20 has two elasticized waistbands 50, one positioned in the back region 28 and one positioned in the front region 26, although other pull-on diaper embodiments can be constructed with a single elasticized waistband. The elasticized waistband 50 may be constructed in a number of different configurations including those described in U.S. Patent 4,515,595 entitled "Disposable Diapers with Elastically Contractible Waistbands" issued to Kievit et al. on May 7, 1985 and the above referenced U.S. Patent 5,151,092 issued to Buell.

Fig. 10 is a cross-sectional view of one preferred embodiment taken along the section line 5-5 of Fig. 8. As shown in Fig. 10, both the backsheet 22 and the topsheet 24 extend beyond the waist edge 154 of the absorbent core 25 to define a waist flap 156. Preferably, the juxtaposed areas of the backsheet 22 and the topsheet 24 are joined together by an adhesive (not shown in Figs.). In a preferred embodiment, the waistband 50 is joined to the waist flap 156. Preferably, the waistband 50 is disposed on and joined to the topsheet 24 as shown in Fig. 10. Alternatively, the waistband 50 can be disposed and joined between the backsheet 22 and the topsheet 24 as shown in Fig. 11. The waistband 50 can be joined to the topsheet 24 (and the backsheet 22) by an adhesive means (not shown in Figs.) such as those well known in the art. For example, the waistband 50 may be secured to the waist flap 156 by a uniform continuous layer of adhesive, a patterned layer of adhesive, or an array of separate lines or spots of adhesive. A preferred adhesive for use is available from Ato Findley Inc., WI, U.S.A., under the designation H2085.

In a preferred embodiment, the waistband 50 is secured to the waist flap 156 in an elastically contractible condition so that in a normally unrestrained configuration the waistband 50 effectively contract or gather the waist flap 156. The waistband 50 can be secured to the waist flap 156 in an elastically contractible condition in at least two ways. For example, the waistband 50 may be stretched and secured to the waist flap 156 while the waist flap 156 is in an uncontracted condition. Alternatively, the waist flap 156 may be contracted, for example by pleating, and the waistband 50 is secured to the contracted waist flap 156 while the waistband 50 in its relaxed or unstretched condition.

Yet alternatively, the waistband 50 is joined, in its relaxed or unstretched condition, to the waist flap 156 which is in an uncontracted condition, thereby forming a composite laminate with the materials of the backsheet 22 and the topsheet 24. At least a portion, preferably the entire portion of the composite laminate is then subjected to mechanical stretching sufficient to permanently elongate the non-elastic components which are the backsheet 22 and the topsheet 24. The composite laminate is then allowed to return to its substantially untensioned condition. Thus, the composite laminate is formed into a "zero strain" stretch laminate which works as elasticized waistband 50.

Herein, "zero strain" stretch laminate refers to a laminate included of at least two plies of material which are secured to one another along at least a portion of their coextensive surfaces while in a substantially untensioned ("zero strain") condition; one of the plies including a material which is stretchable and elastomeric (i.e., will return substantially to its untensioned dimensions after an applied tensile force has been released) and a second ply which is elongatable (but not necessarily elastomeric) so that upon stretching the second ply will be, at least to a degree, permanently elongated so that upon release of the applied tensile forces, it will not fully return to its original undeformed configuration. The resulting stretch laminate is thereby rendered elastically extensible, at least up to the point of initial stretching, in the direction of initial stretching. Particularly preferred methods and apparatus used for making stretch laminates utilize meshing corrugated rolls to mechanically stretch the components. Particularly preferred apparatus and methods are disclosed in U.S. Patent No. 5,167,897 issued to Weber et al. on December 1, 1992; U.S. Patent No. 5,156,793 issued to Buell et al. on October 20, 1990; and U.S. Patent No. 5,143,679 issued to Weber et al. on September 1, 1992.

In a preferred embodiment, the waistband 50 extends across essentially the entire lateral width of the absorbent core 25. Herein, “lateral width” refers to the dimension between the side edges of components of disposable garments. Herein, “across essentially” is used in this context to indicate that the waistband 50 does not need to extend absolutely across the entire width of the absorbent core 25 so long as it extends sufficiently far across the width thereof to provide the elasticized waistband. Preferably, the waistband 50 extends across only a portion of the lateral width of the absorbent core 25, more preferably at least

between portions in the ear panels 46 and 48 (as shown in Fig. 8). In one preferred embodiment, the waistband 50 extends across the entire lateral width of the garment 20 (not shown Figs.).

The extent to which the waistband 50 extends inboard from the end edge 152 of the garment 20, and thus the longitudinal span of the resultant waistband, can vary according to the particular construction of the garment 20. The longitudinal span of the waistband 50 is at least about 5 mm, preferably from about 6 mm to about 60 mm, more preferably from about 15 mm to about 30 mm.

At least one of the ear panels 45, 46 and 48 includes the elastic member 70. Any of the above described elastic composite members can be used as the elastic member 70. For example, each of the front ear panels 46 shown in Fig. 9 includes the elastic member 70 which preferably extends laterally outward from the chassis 41 to provide good fitness by generating the optimal retention (or sustained) force at the waist and side areas of the wearer. Preferably, the elastic member 70 is extensible in at least one direction, preferably in the lateral direction to generate a retention (or sustained) force that is optimal to prevent the pull-on garment 20 from drooping, sagging, or sliding down from its position on the torso without causing the red marking on the skin of the wearer. In a preferred embodiment, each of the ear panels 45, 46 and 48 includes the elastic member 70.

The elastic member 70 is operatively joined to at least one of the nonwoven webs 72 and 74 in the ear panels 45, 46 and 48 to allow the elastic member 70 to be elastically extensible in at least the lateral direction. In a preferred embodiment, the elastic member 70 is operatively joined to the nonwoven webs 72 and 74 by securing them to at least one, preferably both of the nonwoven webs 72 and 74 while in a substantially untensioned (zero strain) condition.

The elastic member 70 can be operatively joined to the nonwoven webs 72 and 74, by using either an intermittent bonding configuration or a substantially continuous bonding configuration. Herein, "intermittently" bonded laminate web means a laminate web wherein the plies are initially bonded to one another at discrete spaced apart points or a laminate web wherein the plies are substantially unbonded to one another at discrete spaced apart areas. Conversely, a "substantially continuously" bonded laminate web means a laminate web

wherein the plies are initially bonded substantially continuously to one another throughout the areas of interface. It is preferred that the stretch laminate be bonded over all or a significant portion of the stretch laminate so that the inelastic webs (i.e., the nonwoven webs 72 and 74) elongate or draw without causing rupture, and the layers of the stretch laminates are preferably bonded in a configuration that maintains all of the layers of the stretch laminate in relatively close adherence to one another after the incremental mechanical stretching operation. Consequently, the elastic panel members and the other plies of the stretch laminate are preferably substantially continuously bonded together using an adhesive. In a particularly preferred embodiment, the adhesive selected is applied with a control coat spray pattern at a basis weight of about 7.0 grams/square m. The adhesive pattern width is about 6.0 cm. The adhesive is preferably an adhesive such as is available from Nitta Findley Co., Ltd., Osaka, Japan, under the designation H2085F. Alternatively, the elastic panel member and any other components of the stretch laminates may be intermittently or continuously bonded to one another using heat bonding, pressure bonding, ultrasonic bonding, dynamic mechanical bonding, or any other method as is known in the art.

After the elastic member 70 is operatively joined to at least one of the nonwoven webs 72 and 74, at least a portion of the resultant composite stretch laminate is then subjected to mechanical stretching sufficient to permanently elongate the non-elastic components which are, for example, the nonwoven webs 72 and 74. The composite stretch laminate is then allowed to return to its substantially untensioned condition. At least one pair of, preferably both of the ear panels 45, 46 and 48 is thus formed into "zero strain" stretch laminates. (Alternatively, the elastic member 70 could be operatively joined in a tensioned condition and then subjected to mechanical stretching; although this is not as preferred as a "zero strain" stretch laminate.)

The elastic member 70 is preferably joined to, more preferably directly secured to the respective edges 78 of the liquid impervious film (i.e., the liquid impervious film 68) through an adhesive 76 as shown in Fig. 9. In a preferred embodiment, while liquid impervious film 68 longitudinally extends in the front, back and crotch regions 26, 28 and 30, it does not laterally extend into at least one of, preferably each of the extensible ear

panels 45, 46 and 48. In a more preferred embodiment, the elastic member 70 is joined to the respective edges 78 of the liquid impervious film 68 at the outer-facing surface 77 as shown in Fig. 9. In an alternative embodiment, the elastic member 70 may be joined to the respective edges 78 of the liquid impervious film 68 at the body-facing surface 79 (not shown in Figs.). Preferably, the adhesive 76 is applied in a spiral glue pattern. In a preferred embodiment, the adhesive 76 is a flexible adhesive with an amorphous and crystallizing component. Such a preferred adhesive is obtainable from Nitta Findley Co., Ltd., Osaka, Japan, under the designation H2085F. Alternatively, the elastic member 70 may be joined to the respective edges 78 of the liquid impervious film 68 by any other bonding means known in the art which include heat bonds, pressure bonds, ultrasonic bonds, dynamic mechanical bonds, or combinations of these attachment means.

Test Methods

1. Tensile Strength

The following method is used to measure the tensile strength of elastic composite members and plane elastomeric materials.

A tensile tester is prepared. The tensile tester has an upper jaw and a lower jaw which is located below the upper jaw. The upper jaw is movable and is connected to an extension force measuring means. The lower jaw is fixed in the tester. A test specimen (i.e., a plane elastomeric material or an elastic composite member to be measured) which has about 2.5 cm (about 1 inch) in width and about 10.2 cm (about 4 inches) in length is prepared and clamped with the upper jaw and the lower jaw so that the effective specimen length (L) (i.e., the initial distance between the upper and lower jaws before application of extension force) is about 5.1 cm (about 2 inch). Preferably, the test specimen is aligned, by clamping, with the direction which is most elastically extensible among all two dimensional directions within the test specimen. (This direction is referred as "primary extensible direction" below.) An extension force is continuously applied to the test specimen through the upper jaw at a cross-head speed of about 50 cm (about 20 inches) per minute, to 300% elongation of the test specimen. The applied extension force is recorded by a recorder (e.g., a computer system). This measurement is conducted for a plane elastomeric material and an elastic composite member. Preferably, this measurement is repeatedly conducted for at least

8 test specimens and the average value of the tensile strength at 100% elongation are obtained from the recorded data.

A tensile tester suitable for use is available from Instron Corporation (100 Royall Street, Canton, MA02021, U.S.A.) as Code No. Instron 5564.

2. Surface Roughness

To measure the surface roughness of the sample, a pianowire is prepared and bent as shown in Figs. 12 and 13. 5.0 gf (allowance, ±0.5 gf) of the contact force is applied by a spring of which spring constant is 25 ±1 gf/mm. The natural frequency of the system should be more than 30 Hz when the contactor is out of the contact.

In the roughness measurement, the specimen is moved between 2 cm interval by a constant velocity of 0.1 cm/sec on a smooth steel plate placed horizontally where the tension of the specimen is kept 5.0 gf/cm (force per unit length) and the contactor is kept its position. The movement direction is an extensible direction of the specimen. The dimension of the plate is shown in Fig. 14. As a result, the change of the thickness T (i.e., the deviation of the surface) are obtained and recorded as shown, for example, in Fig. 15. This measurement is conducted both for two surfaces opposing one another of the sample.

Consequently, the value of Surface Roughness (SRO) is obtained from the following expression:

$$SRO = \frac{1}{X} \int_{0}^{x} | T - T' | \, dx$$

wherein,

x : displacement of the contactor on the surface of sample;

X : 2 cm is taken in this measurement;

T : Thickness of the sample at position x; and

T' : Mean value of T

A suitable equipment for this test is available from Kato Tech Co., Ltd., Kyoto, Japan, under Trade Name “Surface Tester (KES-FB4)”.

It is understood that the examples and embodiments described herein are for illustrative purpose only and that various modifications or changes will be suggested to one skilled in the art without departing from the scope of the present invention.

WHAT IS CLAIMED IS:

1. An elastic composite member elastically extensible in at least one direction, comprising:

a plane elastomeric material having a plurality of apertures formed therein; and

a fibrous material including entanglement fibers, the entanglement fibers being hydroentangled with the plane elastomeric material through the apertures;

wherein the fibrous material has a Strain Resistance (SRE) of less than about 100% at 100% elongation in the extensible direction.

2. The elastic composite member according to Claim 1, wherein the elastic composite member has a stress at 100% elongation of from about 50 gf/inch (about 20 gf/cm) to about 500 gf/inch (about 200 gf/cm).

3. The elastic composite member of Claim 1, wherein the plane elastomeric material has a basis weight from about 30 g/m^2 to about 250 g/m^2, and the fibrous material has a basis weight from about 5 g/m^2 to about 100 g/m^2.

4. The elastic composite member of Claim 1, wherein the elastic composite member has a Surface Roughness (SR) of less than about 10 μm.

5. The elastic composite member of Claim 1, wherein the entanglement fibers are hydroentangled one another uniformly in adjacent apertures of the plane elastomeric material.

6. The elastic composite member of Claim 1, wherein the entanglement fibers are bi-component fibers having a side-by-side cross section or an eccentric cross section.

7. The elastic composite member of Claim 1, wherein the plane elastomeric material is an elastomeric scrim including a plurality of first strands and a plurality of second strands which intersect the first strands thereby forming the plurality of apertures.

8. A disposable article comprising the elastic composite member of Claim 1.

9. The disposable article of Claim 8, wherein the disposable article is a disposable garment including at least one pair of extensible ear panels, and wherein at least one of the ear panels includes the elastic composite member of Claim 1.

10. The disposable garment of Claim 8, wherein the disposable article is a disposable garment including a waistband, and wherein the waistband includes the elastic composite member of Claim 1.

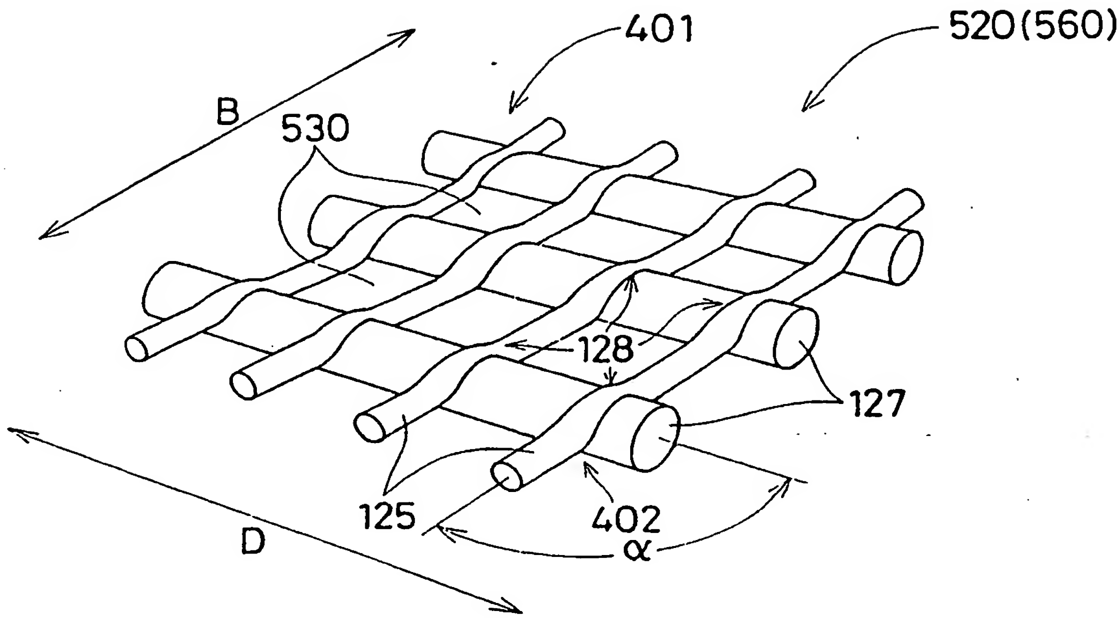
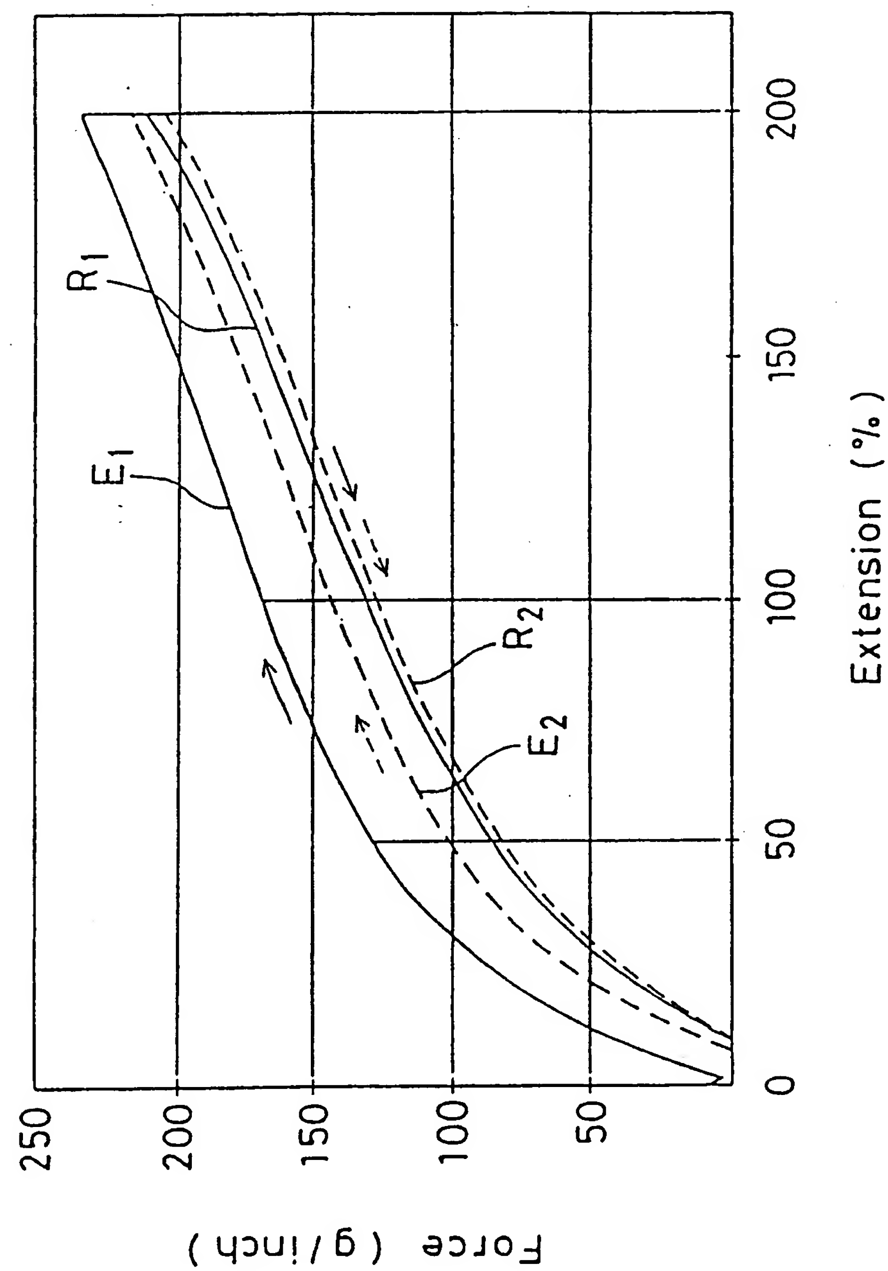


Fig. 1


Force (g / inch)
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200
150
100
50
0
50
100
150
200
Extension (%)
R1
E1
R2
E2

FIG.2

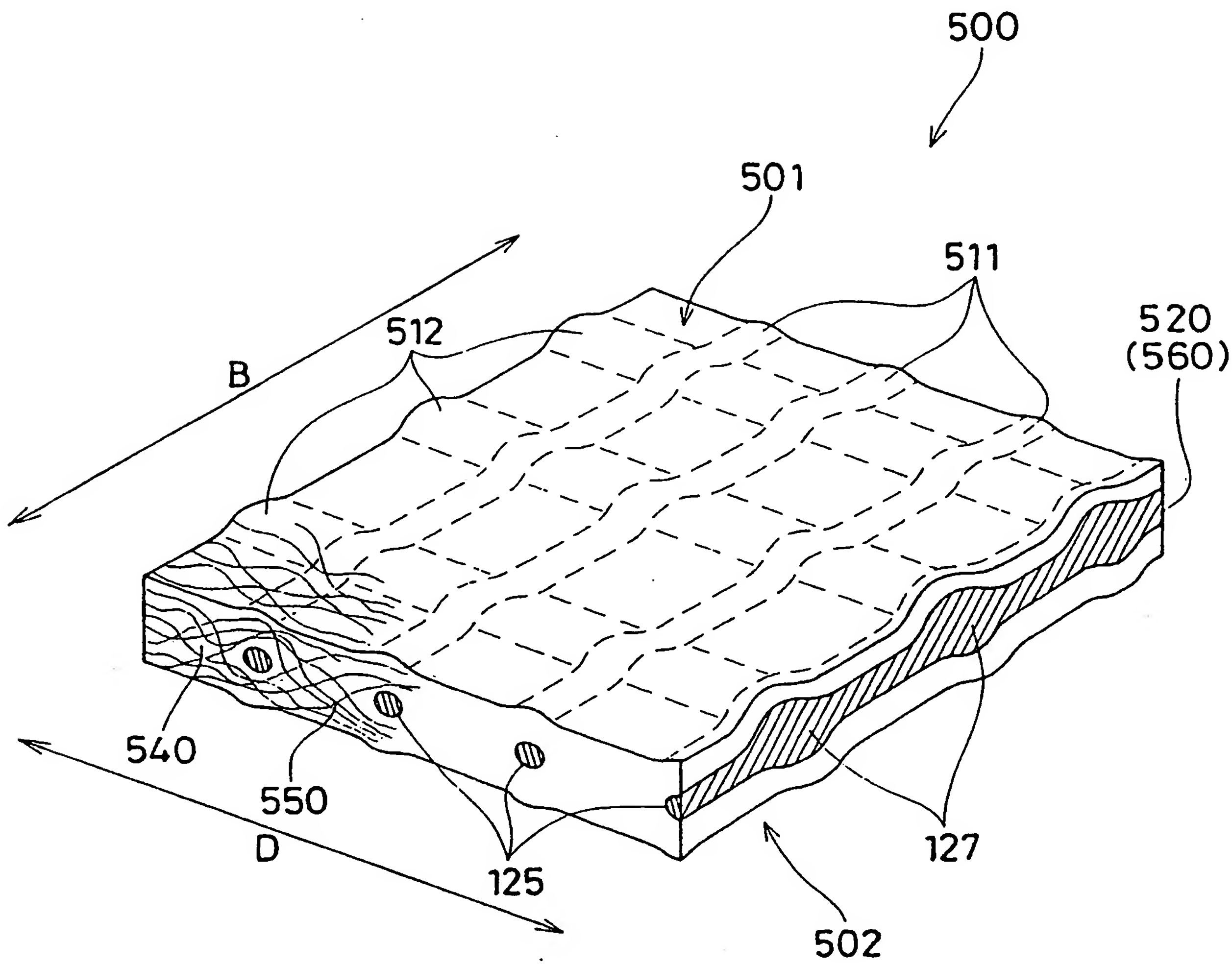


Fig. 3

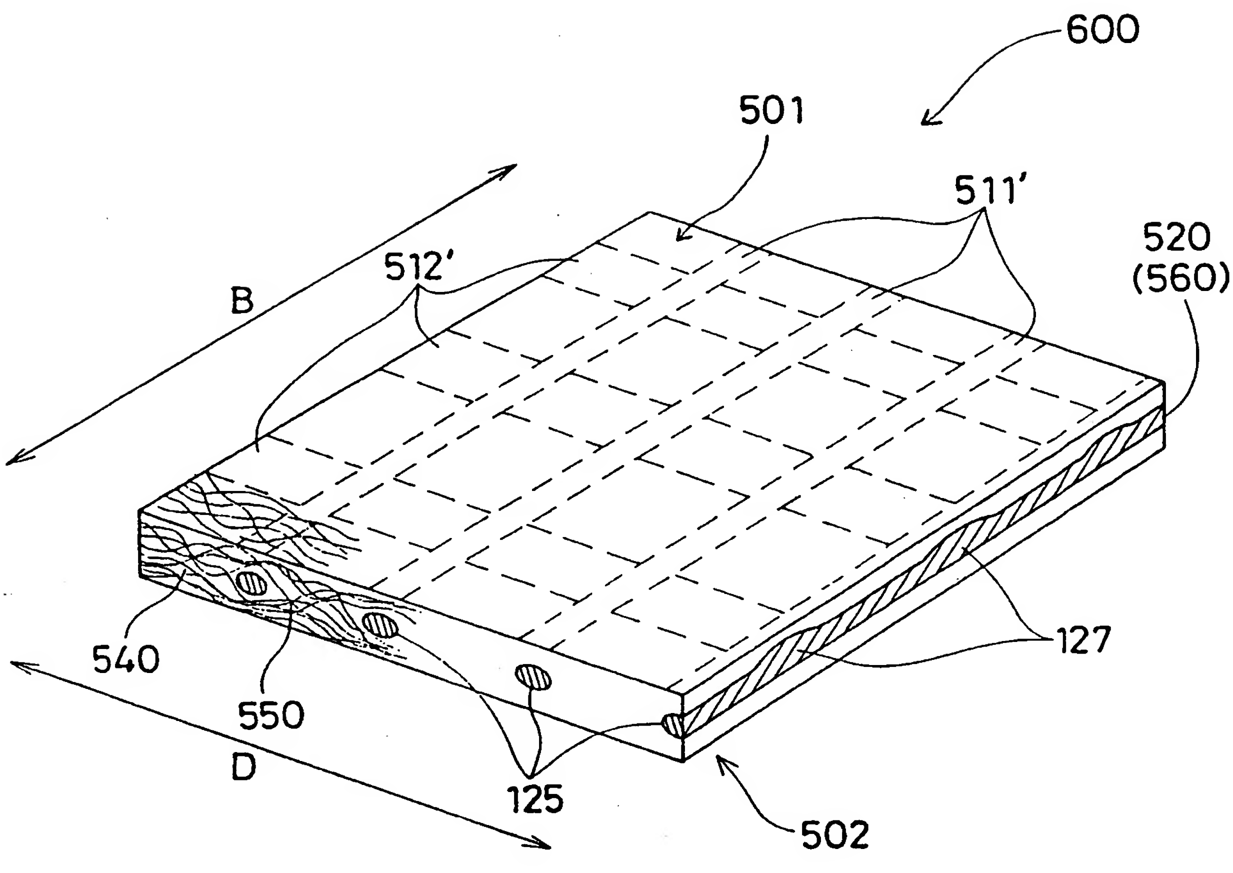


Fig. 4

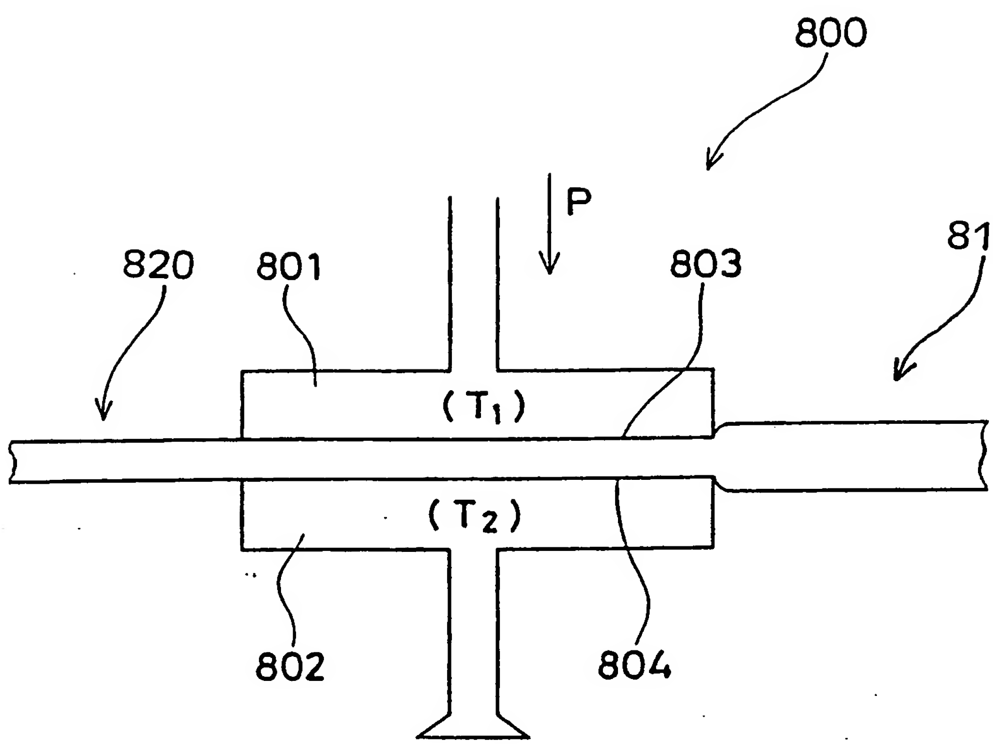
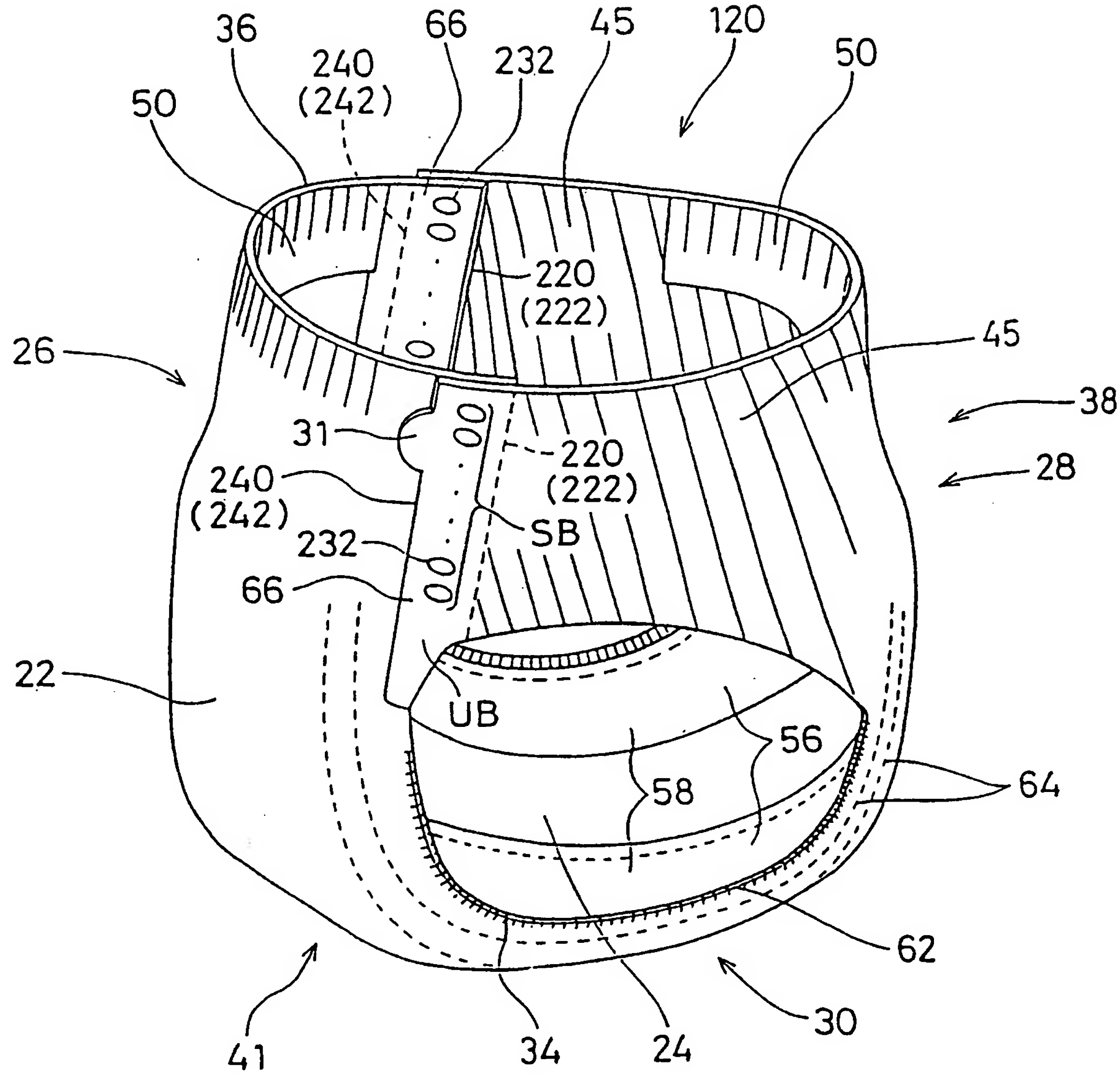


FIG.5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220
(222)
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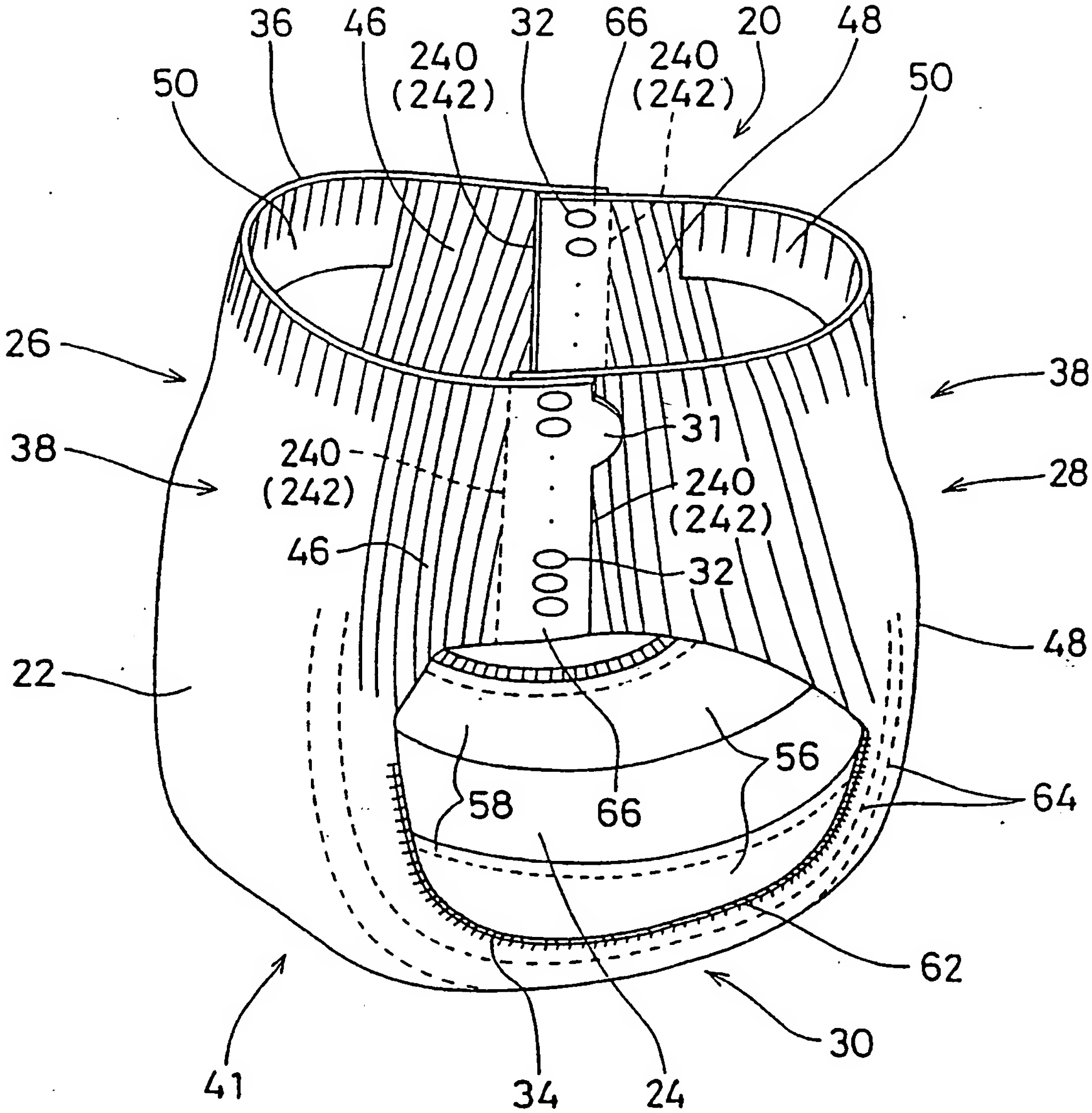
(242)
SB
232
66
22
UB
56
58
64
62
30
41
34
24

FIG.6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22
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56
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41
34
24

FIG.7

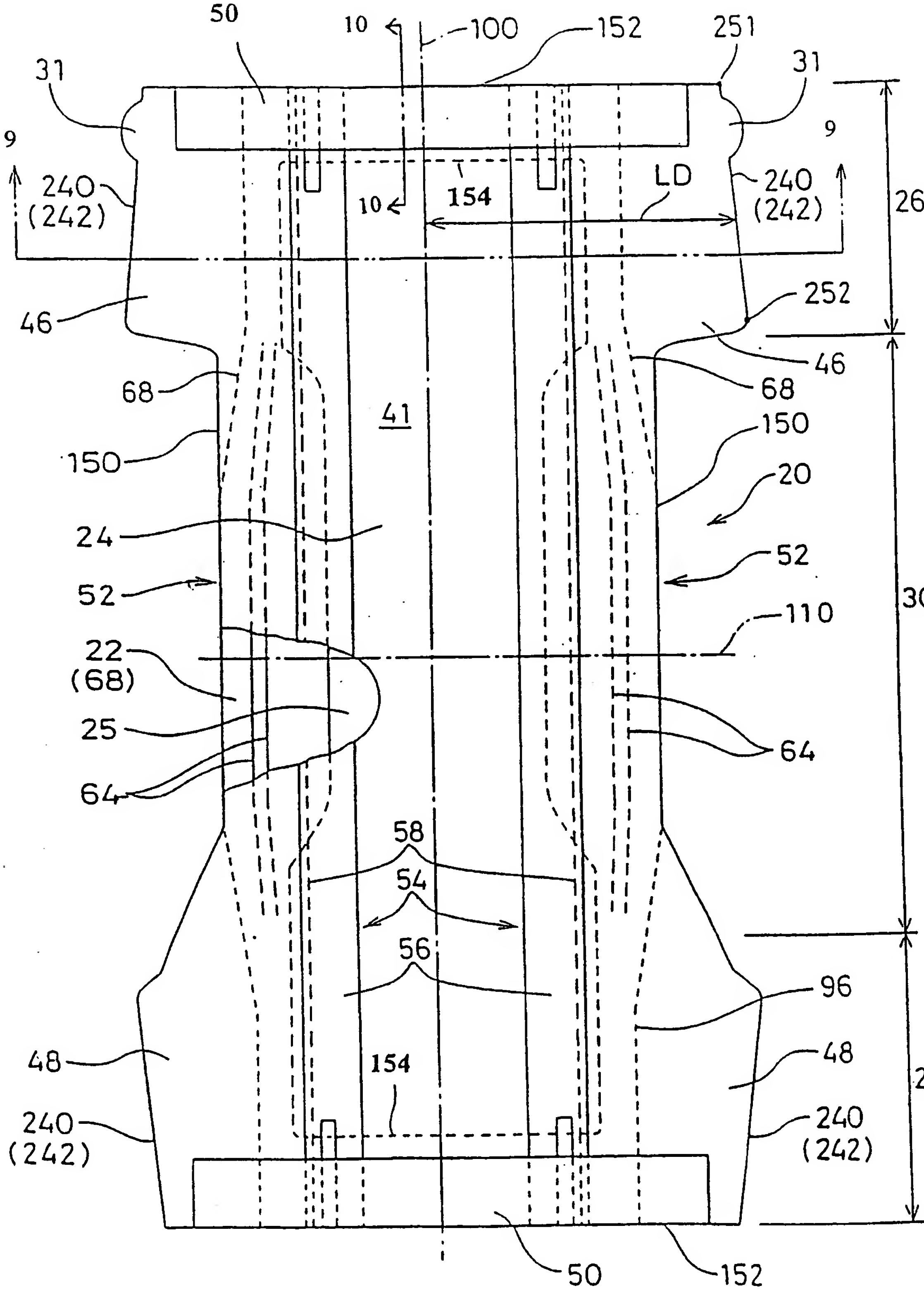
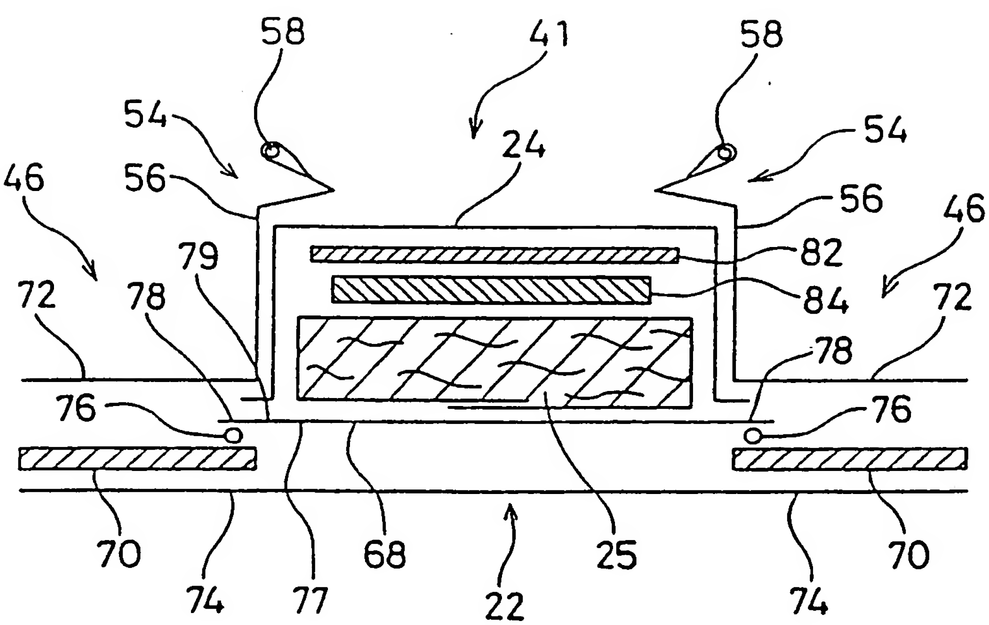


FIG.8

SUBSTITUTE SHEET (RULE 26)


58
41
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54
46
56
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79
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72
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84
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74
77
68
22
25
70
74

FIG.9

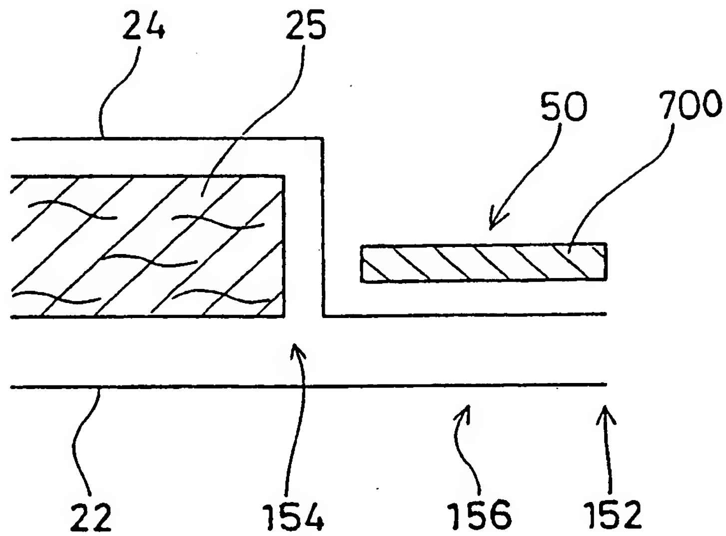

FIG. 10

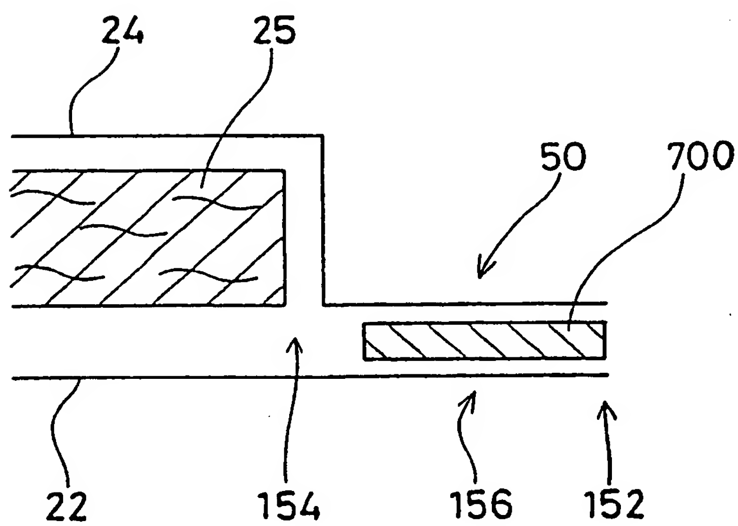

FIG. 11

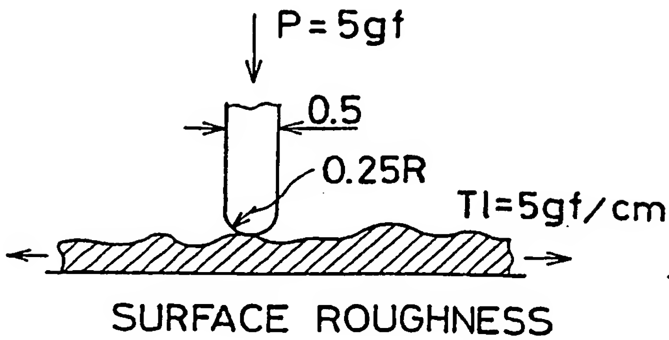

FIG.12

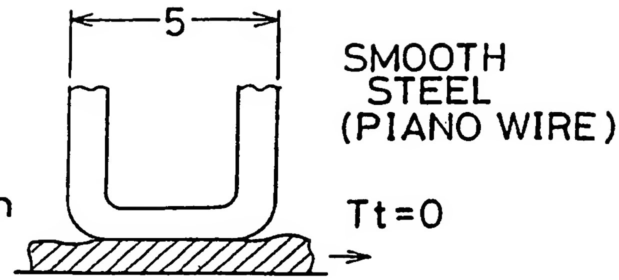

FIG.13

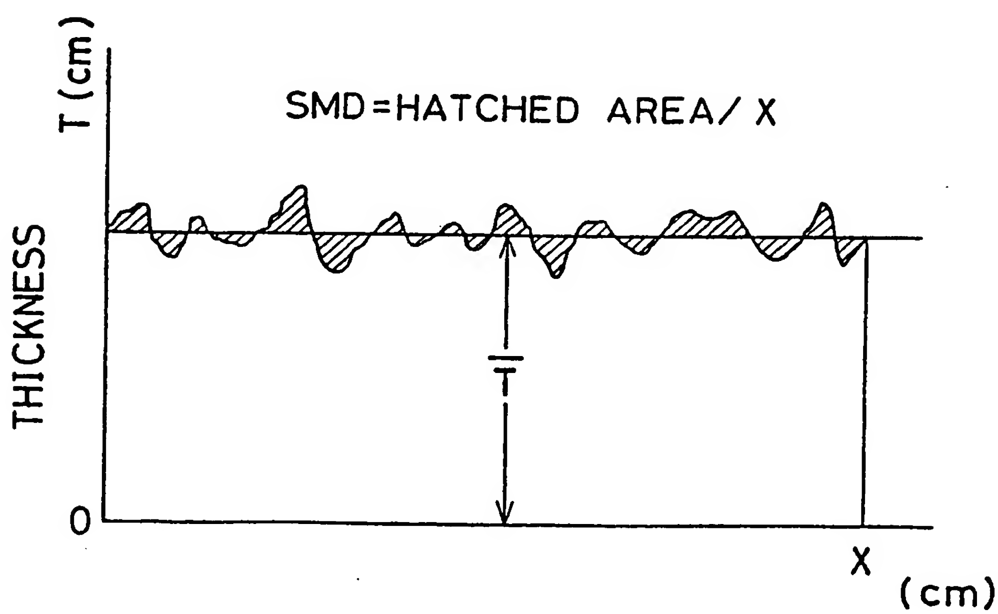

FIG.15

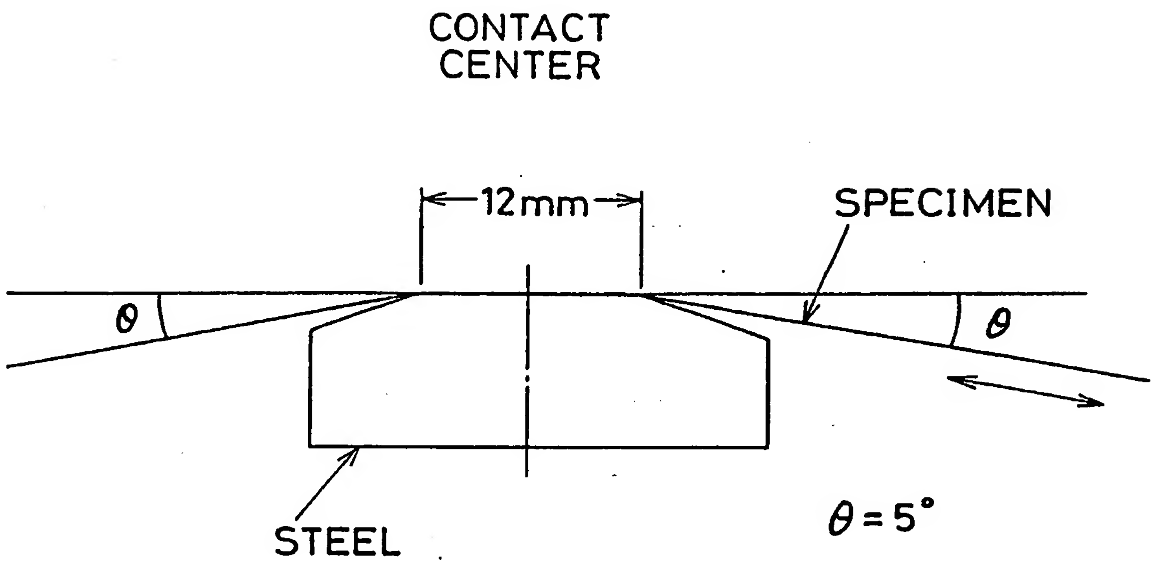

FIG. 14

INTERNATIONAL SEARCH REPORT

International Application No
PC./US 98/27229

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 A61F13/15

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 A61F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5 334 446 A (QUANTRILLE THOMAS E ET AL) 2 August 1994 (1994-08-02) cited in the application abstract column 1, line 12 - line 18 column 4, line 60 - column 5, line 2 column 9, line 41 - line 47; figures 3,4 ---	1,3,5,7,8
A	US 5 413 849 A (AUSTIN JARED A ET AL) 9 May 1995 (1995-05-09) abstract column 1, line 12 - line 19 column 8, line 20 - line 26; figures 3,4 ---	1,7-10

-/--

[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

° Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
8 September 1999	21/09/1999

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL – 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Westermayer, W

Form PCT/ISA/210 (second sheet) (July 1992)

International Application No
PCT/US 98/27229

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	EP 0 023 804 A (JOHNSON & JOHNSON BABY PROD) 11 February 1981 (1981-02-11) page 10, line 16 - line 20 page 13, line 5 - line 10 page 24, line 14 - line 25; figures 1,2,11 -----	1,8-10

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No
PCT/US 98/27229

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